12/16 Bays Fibre/SAS/iSCSI to SAS RAID Subsystem

Manual
Version 1.0

www.raiddeluxe.com

RAID Subsystem

Fibre/SAS/iSCSI to 6Gb/s SAS RAID Subsystem

USER Manual

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FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

Manufacturer's Declaration for CE Certification

We confirm RDL series 12/16-bays 6Gb/s SAS RAID subsystem have been tested and found comply with the requirements set up in the council directive on the approximation of the low of member state relating to the EMC Directive2004/108/EC. For the evaluation regarding to the electromag-netic compatibility, the following standards where applied:

EN 55022: 2006, Class A
EN 61000-3-2: 2006
EN 61000-3-3: 1995+A1: 2001+A2: 2005

EN 55024:1998+A1:2001=A2:2003
IEC61000-4-2: 2001
IEC61000-4-3: 2006
IEC61000-4-4: 2004
IEC61000-4-5: 2005
IEC61000-4-6: 2006
IEC61000-4-8: 2001
IEC61000-4-11: 2004

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1. Introduction

This section presents a brief overview of the 12/16 bays external Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem.

1.1 Overview

SAS 2.0 builds on parallel SCSI by providing higher performance, improving data availability, and simplifying system design. The SAS 2.0 interface supports both 6Gb/s SAS disk drives for data-intensive applications and 6Gb/s Serial ATA (SATA) drives for low-cost bulk storage of reference data. The Fibre/SAS/iSCSI to 6Gb/s SAS RAID controllers attach directly to SATA/SAS midplanes with 3 x Z-PACK HM-Zd high speed connectors or increase capacity using one additional SFF-8088 external connector. When used with SAS expanders, the controller can provide up to (122) devices through one or more SAS JBODs, making it an ideal solution for enterprise-class storage applications that called for maximum configuration flexibility.

The Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem provides three kinds of host interface link to the host board on the server system. This subsystem utilizes the same RAID kernel that has been field-proven in existing internal/external SATA/SAS RAID controller products, allowing to bring stable and reliable SAS RAID external subsystem.

The Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem provides a 2-U/3-U rack-mounted external storage chassis capable of accommodating up to 12/16 6.0-Gb/s, Serial-Attached SCSI (SAS) drives or 6.0-Gb/s Serial ATA (SATA) drives. The redundant controller model provides fault-tolerant links across separate host interface, while the single controller model provides a single, straight-through data path.

Unparalleled Performance

The high speed host interfaces make Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem well suited for professionals who need large capacity and exceptional performance with connectivity. The Fibre/

SAS/iSCSI to 6Gb/s SAS RAID subsystem incorporates onboard high performance 800MHz RAID-on-Chip storage processor and DDR2-800 SDRAM memory to deliver true hardware RAID. The subsystem each includes one DIMM socket with default 1GB of ECC DDR2-800 register SDRAM with optional battery backup module, upgrade to 4GB using x8 or x16 devices. The test result is against overall performance compared to other external SAS RAID subsystems. Applications demand for higher computing power, networking bandwidth and support for virtualization applications are driving RAID subsystem for improved architecture internal bus interface and RAID performance. The powerful new ROC processors integrated 16 x 6Gb/s SAS ports on chip delivers high performance for NAS, server RAID solutions, supercomputing, near-line backup, security systems, streaming and cloud computing applications.

Unsurpassed Data Availability

Designed and leveraged with Areca's existing high performance solution, this controller delivers high-capacity at the best of cost/performance value. It supports the hardware RAID 6 engine to allow two HDDs failures without impact the existing data and performance. Its high data availability and protection derives from the many advanced RAID features.

The Fibre/SAS/iSCSI to SAS RAID subsystems allows easy scalability from JBOD to RAID. It can be configured to RAID levels 0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, Single Disk or JBOD. With innovative new RAID-on-Chip 6Gb/s SAS feature and support for SATA, SAS and SSDs, the Fibre/SAS/iSCSI to SAS RAID subsystems provides small- to mid-sized enterprises with superior levels of RAID performance and scalability for external storage. Using cost-effective SATA disk drive and completely integrated high-performance and data-protection capabilities, it can meet the performance and features of a midrange storage product at an entry-level price.

Easy RAID Management

Configuration and monitoring can be managed either through the LCD control panel, RS232 port or Ethernet port. The firmware also contains an embedded terminal emulation via the RS-232 port. The firmware-embedded web browser-based RAID manager allows

local or remote to access it from any standard internet browser via a 1Gb/s LAN port. The firmware contains SMTP manager monitors all system events and user can select either single or multiple user notifications to be sent via "Plain English" e-mails. The firmware-embedded SNMP agent allows remote to monitor events via LAN with no SNMP agent required. The controller also supports API library for customer to write its own monitor utility.

The controller also supports API library for customer to write its own monitor utility. The Single Admin Portal (SAP) monitor utility can support one application to manage multiple RAID units in the network. The Disk Stress Test (DST) utility kicks out disks meeting marginal spec before the RAID unit is actually put on-line for real business. The hardware monitor can monitor subsystem environment and show the warning message.

1.2 Features

Adapter Architecture

- 800 MHz PowerPC RAID-on-Chip for RAID core and SAS microcode
- Up to 4GB DDR2-800 register SDRAM on one DIMM socket with ECC protection using x8 or x16 devices
- NVRAM for RAID event log & transaction log
- Write-through or write-back cache support
- Redundant flash image for adapter availability
- Real time clock support
- Battery Backup Module ready (Option)
- Management port seamless take-over

RAID Features

- RAID level 0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, Single Disk or JBOD
- Multiple RAID selection
- Online array roaming
- Offline RAID set
- Online RAID level/stripe size migration
- Online capacity expansion and RAID level migration simultaneously
- Online volume set growth
- Support global hot spare and dedicated hot spare
- Instant availability and background initialization

- Automatic drive insertion / removal detection and rebuilding
- Greater than 2TB per volume set (64-bit LBA support)
- Greater than 2TB per disk drive
- Disk scrubbing/ array verify scheduling for automatic repair of all configured RAID sets
- Login record in the event log with IP address and service (http, telnet and serial)
- Support intelligent power management to save energy and extend service life
- Support NTP protocol to synchronize RAID controller clock over the on-board LAN port
- Redundant controller operation with active/active and failover/ failback function
- Dual-active RAID controller with cache mirroring through dedicated high speed bus
- Automatic synchronization of firmware version in the dual-active mode
- Multi-path & load-balancing support (Microsoft MPIO)
- Max 122 devices
- Max 128 LUNs (volume set) per controller

Monitors/Notification

- LCD Control Panel for setup, alarm mute and configuration
- System status indication through LCD, LED and alarm buzzer
- Subsystem management ready

Drive Interface

- Up to 122 devices using SAS expanders (one external Min SAS 4x connector)
- Up to 6Gb/s per port

Host Interface

- 8Gb Fibre-to-SAS
  Four 8Gb/s Fibre Channels - 800MB/sec per channel
- 6Gb SAS-to-SAS
  Two Min SAS 4x 6Gb/s SAS Ports - 600MB/sec per PHY link
- 1Gb iSCSI-to-SAS
  Four 1Gb/s Ethernet Channel - Full iSCSI offload (complete ULP, TCP offload)

RAID Management

- Field-upgradeable firmware in flash ROM

- Firmware-embedded manager via RS-232 port
- Firmware-embedded web browser-based RAID manager- access your RAID subsystem from any standard internet browser via 10/100/1000 LAN port
- Firmware-embedded SMTP manager monitors all system events and user can select either single or multiple user notifications to be sent via "Plain English" e-mails
- Firmware-embedded SNMP agent allows remote to monitor events via 10/100/1000 LAN with no SNMP agent required
- Access terminal menu by telnet via 10/100/1000 LAN port
- API library for customer to write its own monitor utility
- SAP management utility to easily manage multiple RAID units in the network

Software Drivers
- OS Independent

Physical/Electrical
SAS hard drives
- Up to 12/16 2.5-inch or 2.5-inch SAS hot-plug hard drives (6.0 Gb/s) at speeds of 10K or 15K rpm

SATA hard drives
- Up to 12/16 2.5-inch or 3.5-inchSATA hot-plug hard drives (6.0 Gb/s) at speeds of 7.2K or 10K rpm. Connectivity to the controller system backplane is provided through an interposer assembly for redundant controller.

Subsystem Controller Modules
- Controller board 1 or 2 modules
- Sensors 2 sensor per controller Board

Backplane Board
Connectors
- 12/16 SAS hard-drive connectors
- 2 power supply/cooling fan module connectors
- 2 sets of controller board connectors (3 connectors each controller board)

Sensors
- 12/16 temperature sensors (one for each slot)

Controller Back-Panel Connectors

Host connectors (per controller board)
- 2 SAS CH0 and CH1 connector for connection to the host
- 4 Fibre CH0, CH1, CH2 and CH3 connector for connection to the host
- 4 iSCSI CH0, CH1, CH2 and CH3 connector for connection to the host

Expander connector (per controller board)
- 2 SAS "EXP 0 & EXP 1" connector for expansion to an additional SAS JBOD enclosure

Management connector (per controller board)
- 2 6-pin UART RJ-11 connector
- 1 LAN RJ-45 connector
- 2 SAS CH0&CH1 connector for SAS to SAS RAID controller

LED Indicators

Hard-drive carrier
- 1 single-color activity LED status indicator
- 1 two-color fault/power LED status indicator

Controller board
- 2 single-color LED status indicators for each SAS expander port, one for link and one for the activity status

Host board
- 2 single-color LED status indicator per SAS host
- 2 single-color LED status indicator per Fibre host
- 2 single-color LED status indicators per iSCSI host

Power supply/cooling fan module
- 2 single-color LED status indicators for AC_OK and FAULT on each power supply/cooling fan module

Power Supplies

Dual hot swap and redundant with PFC, N+1 design

• Wattage	595 W maximum continuous;
• Voltage	100–240 V rated
• Frequency	50–60 Hz
• Amperage (Max)	6.18A (120 VAC), 3.23A (230 VAC)

Dimensions

2U 12 bays 19-inch rackmount chassis

- Without handles 88.2(H) x 445(W) x 506(D)mm
- With handles 88.2(H) x 482(W) x 542(D)mm

3U 16 bays 19-inch rackmount chassis

- Without handles 88.2(H) x 445(W) x 506(D)mm
- With handles 88.2(H) x 482(W) x 542(D)mm

Subsystem Net Weight (Without Drives)

- Single 12/16 bays 16.5 kg/20.7 kg
- Dual 12/16 bays 17.5 kg/21.7 kg

Environmental

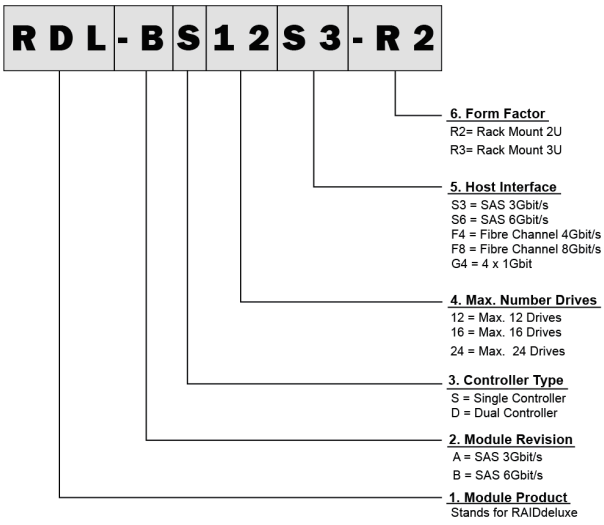
Temperature:

- Operating 0° to 40°C
- Storage –40° to 60°C

Relative humidity:

- Operating 10% to 80% (non-condensing)
- Storage 5% to 95% (non-condensing)

Subsystem Naming Rule

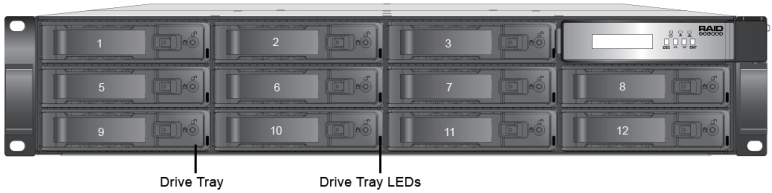


1.3 Locations of the Subsystem Component

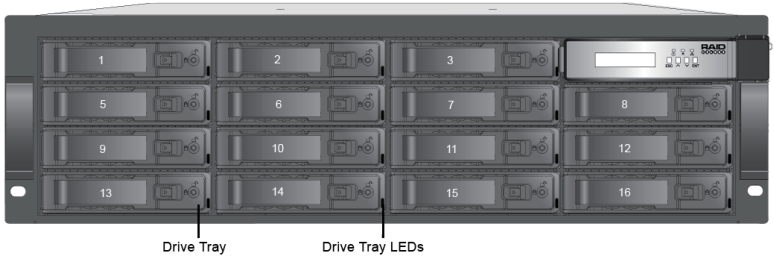
The main components of the Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem are shown in the below figure.

1.3.1 SAS RAID Subsystem Front View

- 2U-12 bays SAS RAID Subsystem Front View



- 3U-16 bays SAS RAID Subsystem Front View



- **Disk Slot Numbers**

To perform a disk hot-plug procedure, you must know the physical disk slot number for the drive that you want to install or remove. The number on the drive tray shows how RAID subsystem disk slots are numbered. Disk slot number is reflected in the RAID manager interface.

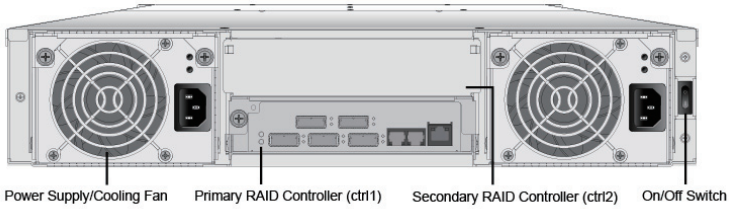
- **Drive Tray LED Indicators**

Each drive tray in your subsystem has two LEDs: an activity LED (blue) and one power/fault (two colors green/red) status LED. The activity LED flashes whenever the drive is accessed. The following table describes the Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem drive tray LED status.

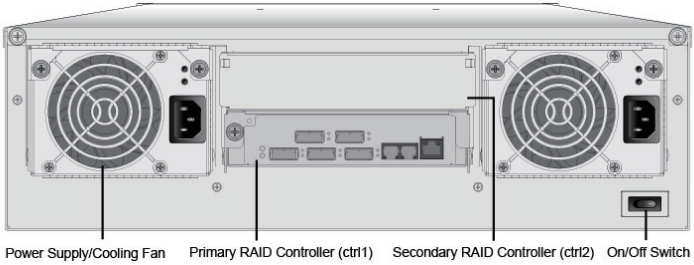
LED	Normal status	Problem Indication
Blue LED (Activity)	When the activity LED is illuminated, there is I/O activity on that disk drive. When the LED is dark; there is no activity on that disk drive.	N/A
Green/Red LED (Power/Fault)	When the power LED (green) is solid illuminated and fault LED (red) is off, that disk is present and status normal. When the fault LED is solid illuminated there is no disk present.	When the fault LED (red) is slow blinking (2 times/sec), that disk drive has failed and should be hot-swapped immediately. When the activity LED (blue) is illuminated and fault LED (red) is fast blinking (10 times/sec) there is rebuilding activity on that disk drive.

1.3.2 SAS RAID Subsystem Rear View

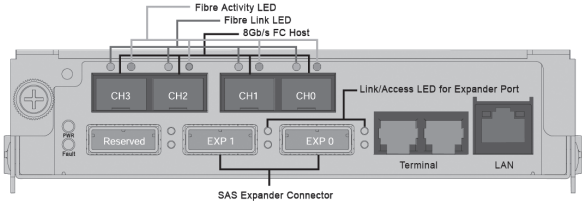
- 2U-12 bays SAS RAID Subsystem Rear View



- 3U-16 bays SAS RAID Subsystem Rear View



1.3.2.1 Rear View of Fibre to SAS RAID Controller

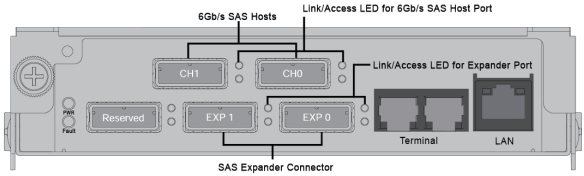


The following table describes the Fibre to 6Gb/s SAS RAID subsystem host channel link/activity LED.

Fibre Host Port LED	Status
Link LED (Green light)	When link LED is illuminated light that indicates the Fibre channel host link has connected.
Activity LED (Blue light)	The Fibre channel host accesses to the Fibre to SAS RAID subsystem.

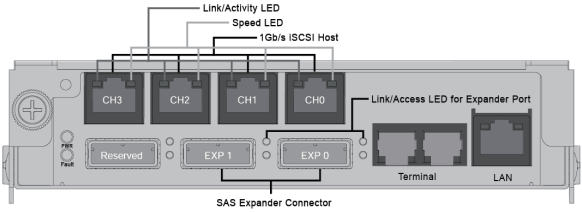
1.3.2.2 Rear View of SAS to SAS RAID Controller

The following table describes the SAS to 6Gb/s SAS RAID subsystem host channel link/access LED.



SAS Host Port LED	Status
Link LED (Green light)	When host port link LED is illuminated for 1 second and turns off for 3 seconds that indicates the one link has connected. When host port Link LED is illuminated for 2 seconds and turns off for 2 seconds that indicates the two links have connected. When host port Link LED is illuminated for 4 seconds that indicates the four links have connected.
Access LED (Blue light)	When access LED is illuminated that indicates the SAS host accesses to the SAS to SAS RAID subsystem.

1.3.2.3 Rear View of iSCSI to SAS RAID Controller

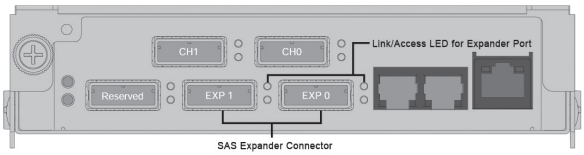


The following table describes the iSCSI to 6Gb/s SAS RAID subsystem host channel link/activity and speed LED.

iSCSI Host Port	Status
Link/Activity LED (Green light)	When Link/Activity LED is flashed that indicates the iSCSI host link has connected. When Link/Activity LED is illuminated that indicates the iSCSI host accesses to the iSCSI RAID subsystem.
Speed LED (Green light)	When speed LED is illuminated that indicates the iSCSI host speed is runing at 1.0Gb/s mode. When Speed LED off that indicates the iSCSI host speed is runing at 10/100 Mb/s mode.

1.3.2.4 Expander Output

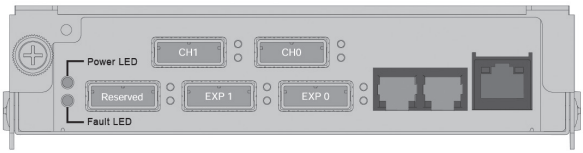
The following table describes the Fibre/SAS/iSCSI to SAS RAID subsystem expander port link/access LED.



Expander LED	Status
Link LED (Green light)	When link LED is illuminated for 1 second and turns off for 3 seconds that indicates the one expander link has connected. When Link LED is illuminated for 2 seconds and turns off for 2 seconds that indicates the two expander links have connected. When Link LED is illuminated for 4 seconds that indicates the four expander links have connected.
Access LED (Blue light)	When access LED is illuminated that indicates the SAS expander connector accesses to next JBOD.

1.3.2.5 Global Status

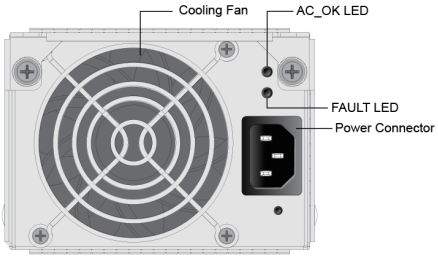
On the left side of RS232 port are two LEDs which indicate the status of the RAID controller working on redundant mode.



Subsystem Indicators	Status
Power LED (Heartbeat/Green light)	When power LED is illuminated that indicates the subsystem in working state. Flashing power LED indicates controller CPU access the subsystem resource.
Fault LED (Red light)	Flashing fault LED indicates a controller reset occurs on a controller.

1.3.2.6 Power Supply/Cooling Fan LED

The enclosure supports two separate power modules. Each of them contains an integrated power supply and two cooling fans. The LEDs on the JBOD enclosure's power supplies indicate status of the power supply: one for AC_OK (green) and other FAULT(red). The following figure is shown LEDs on the power supply module.



The following table describes the power LEDs status.

Power LED Status	Indication
AC_OK (Green LED)	The AC_OK LED indicates that the AC line is present and above the minimum AC input voltage threshold
FAULT (Red LED)	The FAULT LED is driven by the microprocessor and will indicate that a power supply fault has occurred

The power supply cooling shall be provided by the internal tandem fans, powered by the common 12V rail voltage. Fan speed is controlled by PWM input signal. And the power supply firmware shall determine the fan RPM required to provide forced air cooling using data from a thermal sensor in the power supply that reflects the output loading.

The cooling fans included on the power supply run on separate control circuits from the power supply. Therefore, if one power supply fails, the failed power's fan continues to work on the power supplied from the other good power supply.

Note:

A power supply/cooling fan module can be removed from a powered-on enclosure; however, the expander controller may automatically shut down the enclosure if overheating occurs.

1.4 SAS RAID Subsystem Alarm

An audible alarm is activated if any of the fault conditions occur, such as Voltage, Temperature, Fan, Power Supply or from SES2. The "Alert Beeper Setting" function on the RAID System Function is used to disable or enable the RAID subsystem alarm tone generator. The "Mute The Alert Beeper" function on the "RAID System Function" is used to control the Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem beeper. It turns the beeper off temporarily. The beeper will still activate on the next event.

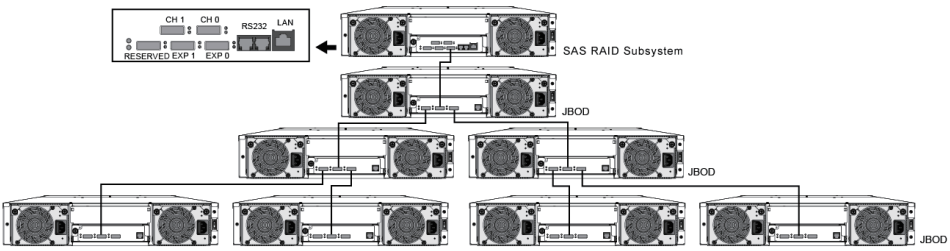
Note:

It is rare for both Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem to fail simultaneously. However, if this occurs, the RAID subsystem can not issue critical or non-critical event alarms for any subsystem component.

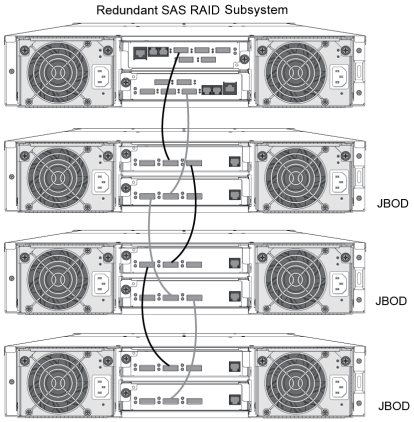
1.5 Expansion Connection

The Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem is a device that contains one expander port. Expander port may support being attached to SAS initiator ports, SAS and/or SATA target ports, and to other expander ports. The Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem can connect up to 7 expander enclosures to the host system. The maximum drive no. is 122 through this RAID subsystem with 7 expander enclosures. Enclosures installed with SAS disks or SATA disks can be included in the same dasiy-chain. The following figure shows how to connect the external Mini SAS cable from the Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem to the external SAS JBOD enclosure. Daisy-chains longer than the limitation of subsystems are not supported even if it may be workable.

- Single Module Mode



- Redundant Controller Mode



The following table is the max no. of Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem supported:

	Disks/ Subsystem	Expander	Devices/Controller	Volume
Max No.	32	8	122	128

Note:

1. Turn on the SAS RAID subsystem first to make sure the host adapter on the server recognizes the drives in the subsystem.
2. Turn on the JBOD first to make sure the SAS RAID subsystem recognizes the drives in the JBOD.

2. Hardware Installation

The following sections show the 12 bays RDL-BS12S6-R2/RDL-BD12S6-R2 installation. An installation with the 16 bays RDL-BS16S6-R3/RDL-BD16S6-R3 is exactly the same. This chapter explains how to install the following components:

- Rack installation
- Drives and drive carriers
- SAS RAID controller boards
- Power supplies

Unpack

Unpack and install the hardware in a static-free environment. The SAS RAID subsystem is packed inside an anti-static bag between two sponge sheets. Remove it and inspect it for damage. If the SAS RAID subsystem appears damaged, or if any items of the contents listed below are missing or damaged, please contact your dealer or distributor immediately.

Checklist

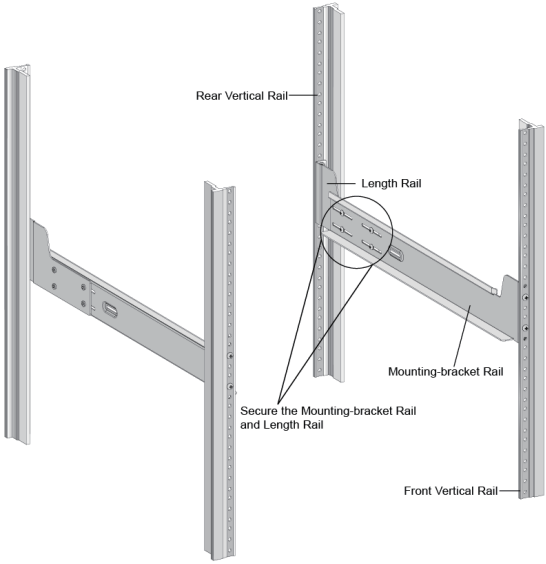
The SAS RAID subsystem kit may have included the following items in the ship package:
- SAS RAID subsystem
- RAID rack kit
- Mounting hardware (attachment rails, screws, etc.)
- SFF-8088 to SFF-8088 cable (option)
- Power cords and power cord clamps
- RJ11 to DB9 serial communications null-modem cable
- Installation Guide (User Manual in the production CD)

Installing into a Subsystem Rack

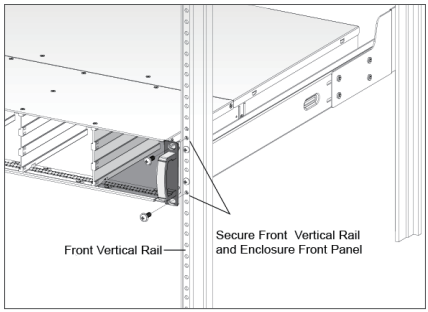
Before you install the rack for your SAS RAID subsystem, please make sure you have these rack kit components:
- One pair of mounting-bracket rail
- One pair of length rail
- 10-32 x 0.5-inch flange-head Phillips screws (8)

2.1 Installing an Subsystem into the Rack or Tower (Optional)

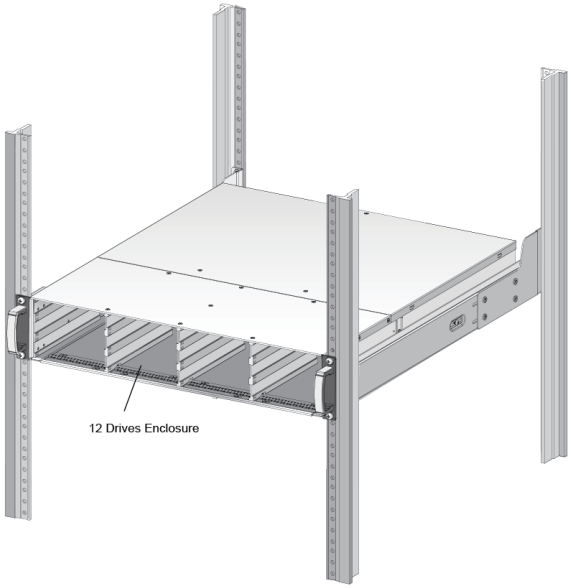
1. Using supplied screws to secure the mounting-bracket rail and length rail and then secure them on the front vertical rail and rear vertical rail, as shown below. Make sure that all connections are tightened before continuing.



2. Slide the rear side of subsystem fully onto the rack until the subsystem front panel touched the front vertical rails. Align the mounting holes of the subsystem on the front vertical rail holes. Secure the subsystem to the front vertical rail and mounting-bracket rail on both sides. The subsystem is too heavy; it needs some assistance from other people to lift it onto the rack together.



3. The rack installation is complete.



2.2 Installing or Removing SAS/SATA Drives in the Subsystem

Your enclosure supports up to 12 3.5-inch disk drives or 2.5-inch SAS or SATA 6.0Gb/s drives, each one contained in its individual drive carrier. Each drive is hot-pluggable, allowing you to remove and insert drives without shutting down your subsystem.

This section describes how to install or remove drives in your subsystem.

Note:

Be careful when handling and storing the drives. The tray provides some protection, but the drives and tray connectors can be damaged by rough handling. When removing the drives from the subsystem, place them on a padded surface. Do not drop the drives.

2.2.1 Installing SAS/SATA Drives in the Enclosure

Follow the steps below to install the 3.5-inch drives or 2.5-inch drives into the drive tray.

a. Install the drives into the drive tray and make sure the holes of the disk trays align with the holes of the drive.

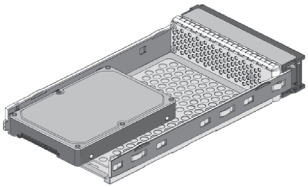


Figure 2-1. Put 2.5-inch SAS/SATA drive into disk tray

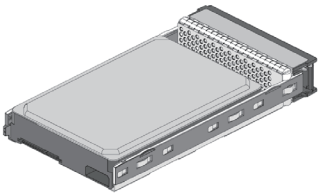


Figure 2-2. Put 3.5-inch SAS/SATA drive into disk tray

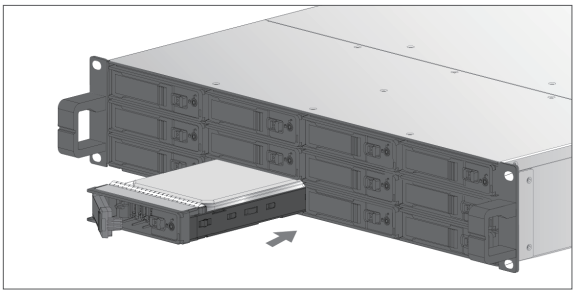
b. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.

Figure 2-3. Drive carrier with 2.5-inch SAS/SATA drive

Figure 2-4. Drive carrier with 3.5-inch SAS/SATA drive

1. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the enclosure drive slot.

2. Gently slide the drive tray back of the enclosure drive slot until the bottom of the open carrier handle makes contact with the enclosure face plate.

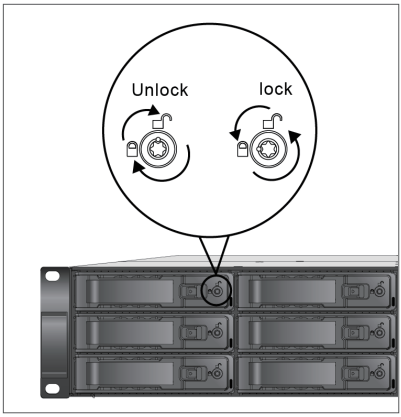


3. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.

Note:

To ensure proper airflow for enclosure cooling, each slot should contain a drive tray.

4. Turn the key-lock to the proper position, using the "Star Wrench L-Handle" in the shopping box. The key-lock is unlock, if the dot on its face is in the unlock orientation.



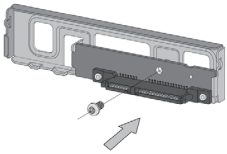
2.2.2 Installing SATA Drives with Interposer Board

The interposer board is for usage with SATA drives. It provides dual data path for redundant controller. If your enclosure has two SAS RAID controllers and you are installing SATA drives, an interposer board is required so that both expander modules can

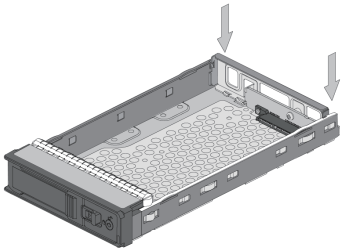
access the SATA drives. Follow the steps below to install the SATA drive with interposer board into the drive tray.

For 2.5-inch drive:

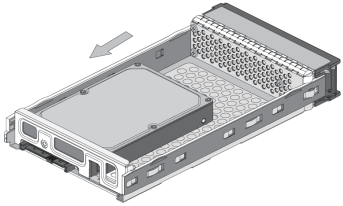
a. Prepare the interposer board.



b. Clip the interposer board into the drive tray.



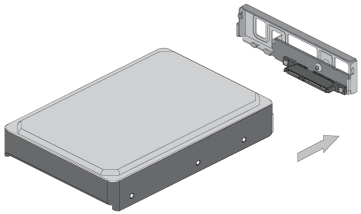
c. Carefully slide the 2.5-inch drive toward the interposer board.



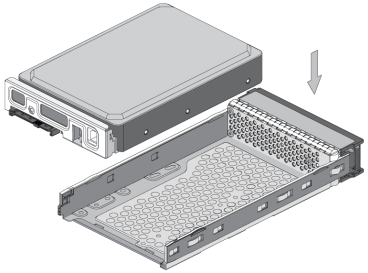
d. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.

For 3.5-inch drive:

a. Slide the 3.5-inch drive toward the interposer board.



b. Position interposer board with drive toward the interposer board slot with the latch point in the interposer board aligned with the interposer board slot. Gently press down the module until it snaps into place in the interposer board slot on the tray.



c. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.

1. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the enclosure drive slot.

2. Gently slide the drive tray back of the enclosure drive slot until the bottom of the open carrier handle makes contact with the enclosure face plate.

3. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.

4. Turn the key-lock to the proper position.

2.2.3 Removing Drives from the Enclosure

1. Don't power the system off until the LED indicator on the drive tray stop flashing.

2. Turn the key-lock to the unlock position.

3. Open the drive tray latch, then gently but firmly pull the drive tray out from the slot.

2.3 Installing or Removing the SAS Series RAID Controller in the Subsystem

A RAID subsystem with redundant function contains two controllers. A RAID subsystem with non-redundant function consists of one controller. If two controllers are installed, a failover function is offered. Control and monitoring of the enclosure elements can be transferred from one controller to another in the event of a controller failure.

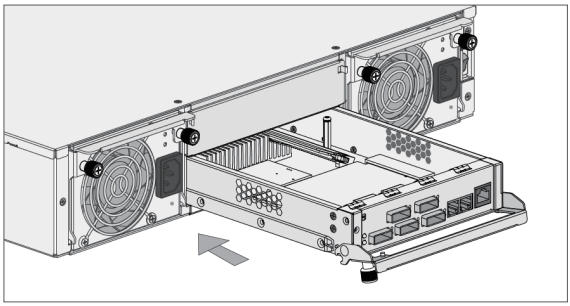
2.3.1 Installing the SAS RAID Controller in the Subsystem

Follow the steps below to install the SAS RAID controller in the subsystem:

1. Carefully slide the SAS RAID controller caddy into the empty slot.

2. Push the SAS RAID controller caddy back of the slot until it is firmly seated in the backplane connector.

3. Put the lever toward the subsystem and tighten the thumbscrew which located on the left side of lever of the SAS RAID controller caddy.



Note:

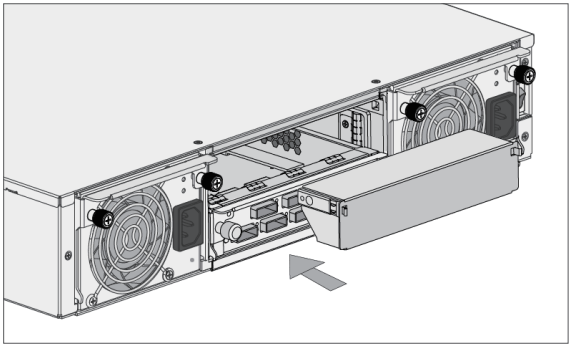
There are two slots for your SAS RAID controller. If you only installed one in your subsystem, the other empty slot must place a cover. To remove the cover, pull out on the thin tabs on each end of the cover and slide the cover out of the slot.

2.3.2 Removing the SAS RAID Controller from the Subsystem

Follow the steps below to remove the SAS RAID controller from the subsystem:

1. Loosen the thumbscrew on left side of the lever, then gently but firmly pull the SAS RAID controller caddy out from the slot.

2. After removed the SAS RAID controller caddy from the subsystem, place the cover in the empty slot.



Note:

At least one SAS RAID controller must be installed in the RAID subsystem. If only one SAS RAID controller is installed, it must be in the primary SAS RAID controller slot and the other one must contain a cover.

2.3.3 Check Controller Memory Module

At least 1GB registered DDR2-800 cache memory is required in each controller. Make sure the cache memory module is present and seated firmly in the DIMM socket (DDR2-800) for series SAS RAID subsystems.

2.3.3.1 Installing the DDR-2 SDRAM DIMM

1. Position the DIMM module toward the socket with the notches in the module aligned with the receptive point on the socket.

2. Gently press down the module until it snaps into place in the socket. The release tabs will hold the DIMM in place.

3. Make sure the selected registered DIMM module using x8 or x16 device on the module.

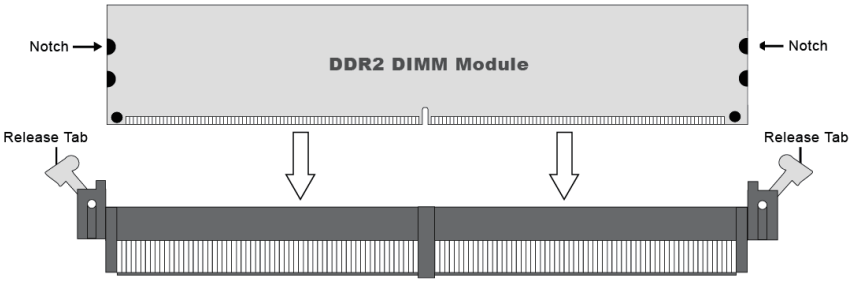
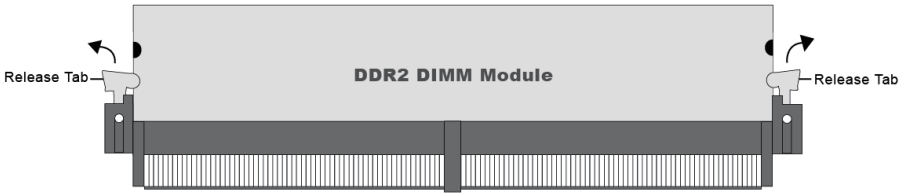


Figure 2-1, Insert module vertically and press gently and firmly down to ensure the module is peoperly seated into socket.

2.3.3.2 Removing the DDR-2 SDRAM DIMM

1. Use your thumbs to gently push the release tabs at both ends of the socket to release it from the socket.



2.3.4 Adding a Battery Backup Module (Option)

Please refer to Appendix B for installing the BBM in your series SAS RAID subsystem.

2.4 Installing and Removing the Power Supply/Cooling Fan Modules

The subsystem supports two separate power modules. Each of them contains an integrated power supply and one cooling fan.

2.4.1 Installing the Power Supply/Cooling Fan Modules

1 Carefully slide the power supply/cooling fan modules into the empty slot.

2 Push the module back of the slot until it is firmly seated in the backplane connector.

3 Tighten the two thumbscrews to secure the power supply/cooling fan modules.

4. Connect the AC power cords to a grounded electrical outlet and to the power supply.

Note:

The power supply/cooling fan modules are heavy. Be carefully when you lift it up into the slot.

2.4.2 Removing a Power Supply/Cooling Fan Modules

1. Turn off the power supply and unplug the AC power cords.

2. Loosen the thumbscrew on power supply/cooling fan module then gently but firmly pull the power supply/cooling fan modules out from the slot.

Note:

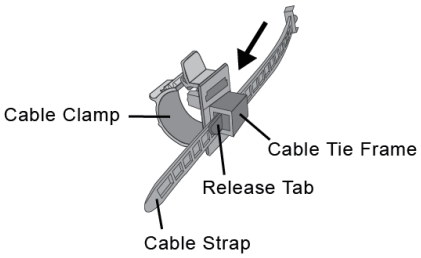
1. Power supply/cooling fan modules are hot-pluggable. Provided one power supply/cooling fan module is functioning normally, you can remove or replace the other while the subsystem is powered on.

2. If you remove a fully functioning power supply/cooling fan module, the fan speed in the remaining module will increase significantly to provide adequate cooling. The fan speed will decrease gradually when a new power supply/cooling fan module is installed.

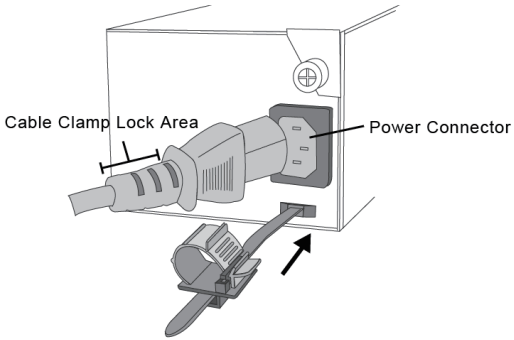
2.5 Installing the Power Cord Clamp

Using the included power cords, connect each power supply and cooling fan unit to an AC power source. (manufacture recommends that you use an uninterruptible power supply to protect your SAS RAID subsystem.) The cable clamp prevents the power cord from being accidently unplugged.

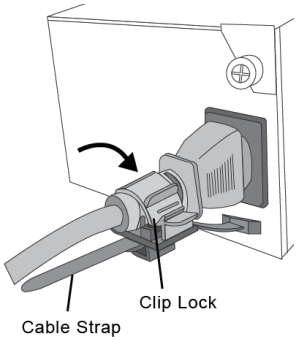
1. Connect the cable clamp to the cable strap. Opening the release tab then insert the angled end of cable strap through the cable tie frame. Facing up of cable strip smooth side and the other side facing down.



2. Connect the power cord and connect the cable strap with opening cable clamp to the power module. Using the release tab to adjust the cable clamp to the suitable place.



3. Using cable clamp wrap the power cord and clip lock it. Repeat step 1 to 3 to install the power cord clamp on the other side.



2.6 Connecting the RAID Subsystem

Once the SAS RAID subsystem has finished the installation of hardware components, then you can connect it to a host computer. The SAS RAID subsystem can be connected to a host computer through the SAS, Fibre or iSCSI interface. User can select the right cable connected to the host controller or other SAS JBOD enclosure.

2.6.1 Connecting to Host System

The external host connector is provided on the back of the SAS RAID subsystem for connecting the array to server host adapter. By installing host port adapter and RAID subsystem using the correct external cables which is included in your SAS RAID subsystem kits. Then connect SAS RAID subsystem and host port adapter as shown below:

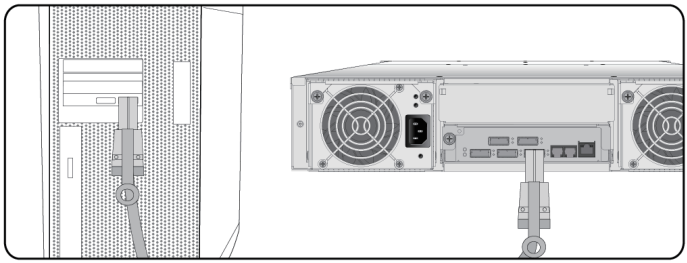
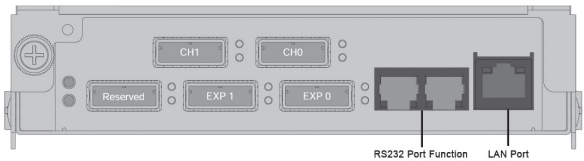


Figure 2-6 Connect SAS RAID subsystem and host adapter

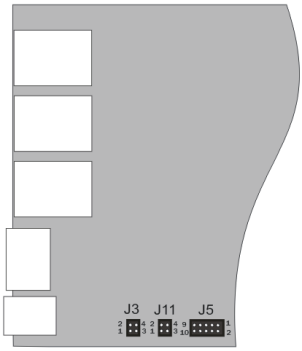
2.6.2 Connecting Monitor Port

The SAS RAID subsystem is normally delivered with LCD pre-installed. Your SAS RAID subsystem can be configured by using the LCD with keypad, a serial device (terminal emulation) or LAN port.



- **RS232C Port Connection**

  The SAS RAID subsystem can be configured via a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program. You can attach a serial (Character-Based) terminal or server com port to the SAS RAID subsystem for access to the text-based setup menu. There are two multiple function on those RJ11. The J3 jumper is on the controller board used to define the RS 232 port connectors (VT-100 for expander/Debug and VT-100 for controller) function.



J3 jumper	RJ11 Beside Expander Port	RJ11 Beside LAN Port
1-2	Controller Debug Port	Expander Port
3-4 (Default)	Expander Port	Controller VT-100 Port
No Cap	Controller Debug Port	Controller VT-100 Port

Table 2-2, RS232C port function definition

- **LAN Port Connection**

  The SAS RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware(method 3). User can remote manage the SAS RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100/1000 Ethernet RJ45 LAN port. Connect Ethernet port of the SAS RAID subsystem using the included Ethernet cable and then to a LAN port or LAN switch.

2.6.3 Power Up the RAID Subsystem

There is one main power on/off switch located on the rear side of the RAID subsystem. This on/off power switch is used to apply or remove power from the power supply to the RAID subsystem. Turning off subsystem power with this switch removes the main power but keeps standby power supplied to the RAID subsystem. Therefore, you must unplug the power cord before subsystem servicing.

The cooling fan included on the power supply run on separate control circuits from the power supply. Therefore, if one power supply fails, the failed power's fan continues to work on the power supplied from the other good power supply.

The installation is completed. You can use your SAS RAID subsystem.

Note:

A power supply/cooling fan module can be removed from a powered-on subsystem; however, the subsystem should shut down if overheating occurs.

2.7 Configuring RAID Subsystems

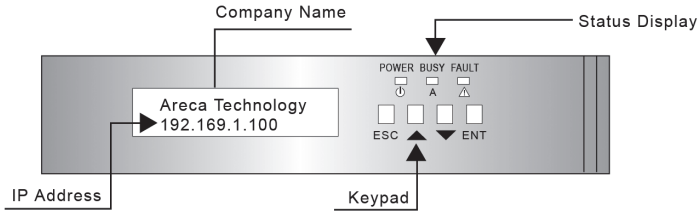
There are often multiple ways to accomplish the same configuration and maintenance tasks for your SAS RAID subsystem. The SAS RAID subsystem is normally delivered with LCD preinstalled. Your SAS RAID subsystem can be configured by using the LCD with keypad, a serial device (terminal emulation) or LAN port. Turn to the relative section of RAID configuration in the user manual for information about detail configuring RAID arrays.

2.7.1 Configuring Method

• Method 1: LCD Panel with Keypad

You can use LCD front panel and keypad function to simply create the RAID volume. The LCD status panel also informs you of the disk array's current operating status at a glance. For additional information on using the LCD to configure the RAID subsystem see the Chapter 4 of LCD Configuration.
The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The initial screen is shown as below:



• Method 2: RS-232 Port Connection
For additional information on using the RS-232 port to configure the SAS RAID subsystem see the Chapter 5 of VT-100 Utility Configuration.

• Method 3: LAN Port Connection
For additional information on using the LAN port to configure the RAID subsystem see the Chapter 6 of Web Browser-Based Configuration.

Note:

It's a good ideal to turn on your SAS RAID subsystem before turning on the host computer. This will insure that the host computer recognize the volumes and drivers in the SAS RAID subsystem.

2.7.2 Format, Partition and Mount the SAS RAID Subsystem Volumes

Safety checks the installation. Connect all power cords. Turn on the AC power switch at the rear of host computer then press the power button at the front of the host computer.

After you create a unit, it needs to be partitioned, formatted, and mounted by the operating system. There are various steps, that depend on what operating system you are using (Windows, Linux, FreeBSD or Mac, etc.). Detailed steps for each operating system are provided on their disk utility. After that, the SAS RAID subsystem can be fully used.

3. Configuration Methods

After the hardware installation, the SAS/SATA disk drives connected to the SAS RAID subsystem must be configured and the volume set units initialized before they are ready to use. This can be accomplished by one of the following methods:

- Front panel touch-control keypad.
- VT100 terminal connected through the controller's serial port.
- Firmware-embedded & web browser-based RAID manager/SNMP agent/SMTP via the controller's 10/100/1000 LAN port.

Those user interfaces can access the built-in configuration and administration utility that resides on the controller's firmware. They provide complete control and management of the controller and disk arrays, eliminating the need for additional hardware or software.

Note:

The SAS RAID subsystem allows only one method to access menus at a time.

3.1 Using Local Front Panel Touch-control Keypad

The front panel keypad and liquid crystal display (LCD) is the primary user interface for the SAS RAID subsystem. All configuration and management of the controller and its properly connected disk arrays can be performed from this interface.

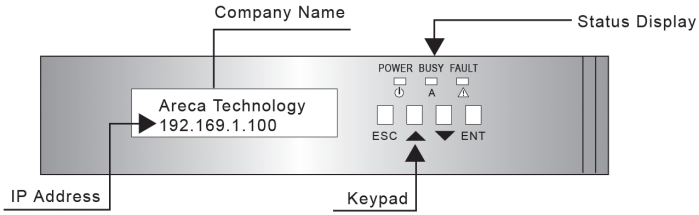
The front panel keypad and LCD are connected to the RAID subsystem to access the built-in configuration and administration utility that resides in the controller's firmware. Complete control and management of the array's physical drives and logical units can be performed from the front panel, requiring no additional hardware or software drivers for that purpose.

CONFIGURATION METHOD

A touch-control keypad and a liquid crystal display (LCD) mounted on the front of the RAID subsystem is the primary operational interface and monitor display for the disk array controller. This user interface controls all configuration and management functions for the RAID subsystem it is properly connected.

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The initial screen is shown as the following:



Function Key Definitions:
The four function keys at the button of the front perform the following functions:

Key	Function
Up Arrow	Use to scroll the cursor Upward/Rightward
Down Arrow	Use to scroll the cursor Downward/Leftward
ENT Key	Submit select ion function (Confirm a selected item)
ESC Key	Return to previous screen (Exit a selection configuration)

There are a variety of failure conditions that cause the SAS RAID subsystem monitoring LED to light. Following table provides a summary of the front panel LED.

Panel LED	Normal Status	Problem Indication
Power LED	Solid green, when power on	Unlit, when power on
Busy LED	Blinking amber during host accesses SAS RAID subsystem	Unlit or never flicker
Fault LED	Unlit	Solid red

For additional information on using the LCD panel and keypad to configure the SAS RAID subsystem see "LCD Configuration Menu" on Chapter 4.

3.2 VT100 Terminal (Using the controller's serial port)

The serial port on the SAS RAID subsystem's front can be used in VT100 mode. The provided interface cable converts the RS232 signal of the 6-pin RJ11 connector on the RAID subsystem into a 9-pin D-Sub female connector. The firmware-based terminal array management interface can access the array through this RS-232 port. You can attach a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program to the serial port for accessing the text-based setup menu.

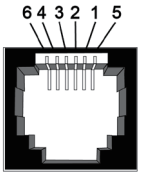
3.2.1 RAID Subsystem RS-232C Port Pin Assignment

To ensure proper communications between the RAID subsystem and the VT-100 Terminal Emulation, Please configure the VT100 terminal emulation settings to the values shown below:

Terminal requirment	
Connection	Null-modem cable
Baud Rate	115,200
Data bits	8
Stop	1
Flow Control	None

The VT-100 port for the SAS RAID configuration, please refer to table 2-2 in chapter 2. The controller VT-100 RJ11 connector pin assignments are defined as below.

Pin Assignment			
Pin	Definition	Pin	Definition
1	RTS (RS232)	4	GND
2	RXD (RS232)	5	GND
3	TXD (RS232)	6	GND



Keyboard Navigation

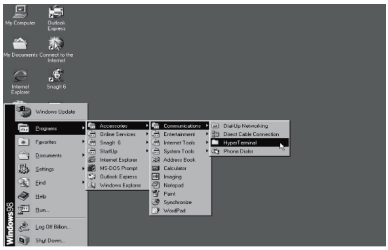
The following definition is the VT-100 RAID configuration utility keyboard navigation.

Key	Function
Arrow Key	Move cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line draw
X Key	Redraw

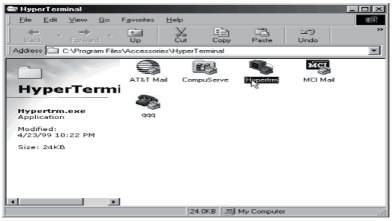
3.2.2 Start-up VT100 Screen

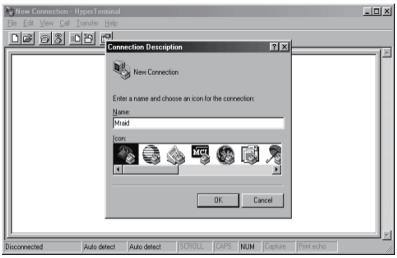
By connecting a VT100 compatible terminal, or a PC operating in an equivalent terminal emulation mode, all SAS RAID subsystem monitoring, configuration and administration functions can be exercised from the VT100 terminal.
There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is an example setup VT100 Terminal in Windows system using Hyper Terminal use Version 3.0 or higher.

Step 1. From the Desktop open the start menu. Pick Programs, Accessories, Communications and Hyper Terminal. Open Hyper Terminal (requires version 3.0 or higher)

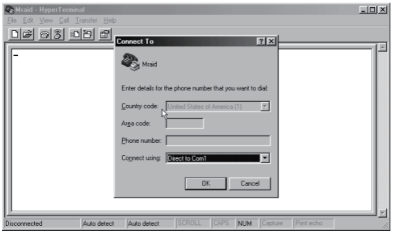


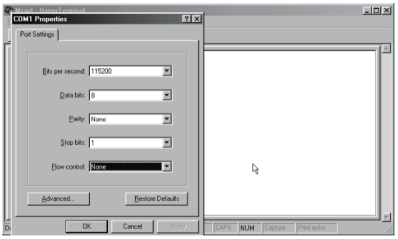
Step 2. Open **HYPERTRM.EXE** and enter a name for your Terminal. Click **OK**.



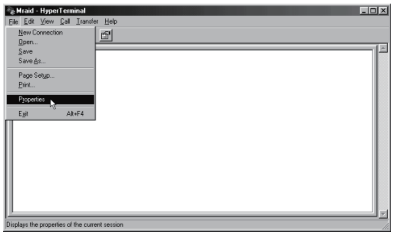


Step 3. Select an appropriate connecting port in your Terminal. Click OK. Configure the port parameter settings. Bits per second: "**115200**", Data bits: "**8**", Parity: "**None**", Stop bits: "**1**", Flow control:" **None**". Click "**OK"**

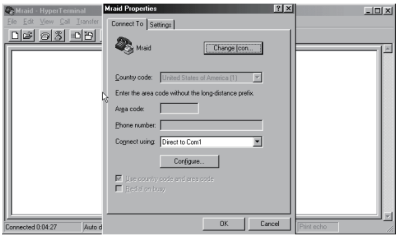




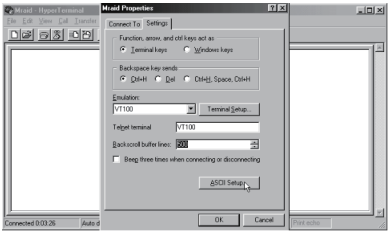
Step 4. Open the File menu, and then open Properties.



Step 5. Open the Settings Tab.



Step 6. Open the Settings Tab. Function, arrow and ctrl keys act as: Terminal Keys, Backspace key sends: "**Crtl+H"**, Emulation: VT100, Telnet terminal: VT100, Back scroll buffer lines: 500. Click **OK**.



Now, the VT100 is ready to use.
After you have finished the VT100 Terminal setup, you may press " **X** " key (in your Terminal) to link the RAID subsystem and Terminal together.
Press" **X** " key to display the disk array Monitor Utility screen on your VT100 Terminal.

3.3 Web Browser-based RAID Manager

To configure SAS RAID subsystem on a local or remote machine, you need to know its IP Address. The IP address will default show in the "LCD" screen or "Ethernet Configuration" option on the VT100 utility configration. Launch your firmware-embedded TCP/IP & web browser-based RAID manager by entering http://[IP Address] in the web browser.

The provided LAN interface cable connects the SAS RAID subsystem LAN port into a LAN port from your local network. Use only shield cable to avoid radiated emission that may cause interruptions. To ensure proper communications between the RAID subsystem and web browser-based RAID management, Please connect the SAS RAID subsystem LAN port to any LAN switch port.

The SAS RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the SAS RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100/1000 RJ45 LAN port.

The storage console current configuration screen displays the current configuration of your SAS RAID subsystem. Detail procedures please refer to the Chapter 6 Web Browser-based Configuration method.

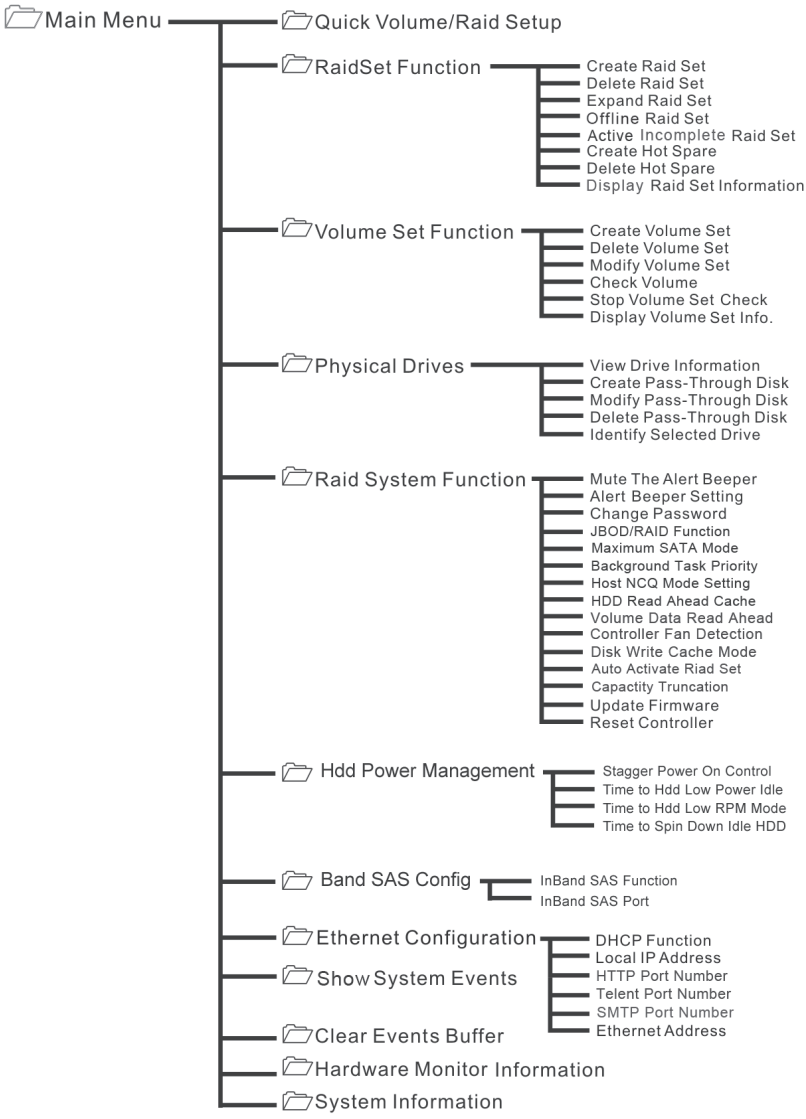
Note:

You must be logged in as administrator with local admin rights on the remote machine to remotely configure it.
The SAS RAID subsystem default user name is “admin” and the password is “0000”.

3.4 Configuration Menu Tree

The following is an expansion of the menus in configuration utility that can be accessed through the LCD panel, RS-232 serial port and LAN port.

CONFIGURATION METHOD



Note:

Ethernet Configuration, Alert By Mail Config, and SNMP Config can only be set in the web-based configuration.

4. LCD Configuration Menu

After the hardware installation, the disk drives connected to the RAID subsystem must be configured and the volume set units initialized before they are ready to use. This can be also accomplished by the front panel touch-control keypad.

The LCD module on the front side can access the built-in configuration and administration utility that resides in the controller's firmware. To complete control and management of the array's physical drives and logical units can be performed from the front panel, requiring no additional hardware or software drivers for that purpose.

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The LCD display front panel function keys are the primary user interface for the RAID subsystem. Except for the "Firmware update", all configurations can be performed through this interface.

Function Key Definitions
The four function keys at the front panel of the button perform the following functions:

Key	Function
Up Arrow	Use to scroll the cursor Upward/Rightward
Down Arrow	Use to scroll the cursor Downward/Leftward
ENT Key	Submit select ion function (Confirm a selected item)
ESC Key	Return to previous screen (Exit a selection configuration)

4.1 Starting LCD Configuration Utility

After power on the SAS RAID subsystem, press **ENT** to verify password for entering the main menu from LCD panel. Using the **UP/DOWN** buttons to select the menu item, then press **ENT** to confirm it. Press **ESC** to return to the previous screen.

4.2 LCD Configuration Utility Main Menu Options

Select an option, related information or submenu items to display beneath it. The submenus for each item are explained on the section 4.7.2. The configuration utility main menu options are:

Option	Description
Quick Volume And Raid Set Setup	Create a default configurations which are based on the number of physical disk installed
Raid Set Functions	Create a customized RAID set
Volume Set Functions	Create a customized volume set
Physical Drive Functions	View individual disk information
Raid System Functions	Setting the raid system configurations
Ethernet Configuration	LAN port setting
Show System Events	Record all system events in the buffer
Clear All Event Buffers	Clear all event buffer information
Hardware Monitor Information	Show all system environment status
Show System information	View the controller information

4.3 Configuring Raid Sets and Volume Sets

You can use "Quick Volume And Raid Set Setup" or "Raid Set Functions" and "Volume Set Functions" to configure RAID sets and volume sets from LCD panel. Each configuration method requires a different level of user input. The general flow of operations for RAID set and volume set configuration is:

Step	Action
1	Designate hot spares/pass-through (optional)
2	Choose a configuration method
3	Create RAID set using the available physical drives
4	Define volume set using the space in the RAID set
5	Initialize the volume set and use volume set in the host OS

4.4 Designating Drives as Hot Spares

To designate drives as hot spares, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Raid Set Functions" option and then press **ENT**. All RAID set functions will be displayed. Press **UP/DOWN** buttons to select the "Create Hot Spare Disk" option and then press **ENT**. The first unused physical device connected to the current RAID subsystem appears. Press **UP/DOWN** buttons to scroll the unused physical devices and select the target disk to assign as a hot spare and press **ENT** to designate it as a hot spare.

4.5 Using Easy RAID Configuration

In "Quick Volume And Raid Setup" configuration, the RAID set you create is associated with exactly one volume set, and you can modify the Raid Level, Stripe Size, and Capacity. Designating drives as hot spares will also combine with RAID level in this setup.
The volume set default settings will be:

Parameter	Setting
Volume Name	Volume Set # 00
SAS Port#/LUN Base/LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

The default setting values can be changed after configuration is completed.
Follow the steps below to create RAID set using "Quick Volume And Raid Setup" configuration:

Step	Action
1	Choose "Quick Volume And Raid Setup" from the main menu. The available RAID levels with hot spare for the current volume set drive are displayed.

2	It is recommended to use drives have same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will select the lowest capacity of the drive in the RAID set. The numbers of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires 1 or more physical drives RAID 1 requires at least 2 physical drives RAID 1+Spare requires at least 3 physical drives RAID 3 requires at least 3 physical drives RAID 5 requires at least 3 physical drives RAID 3 +Spare requires at least 4 physical drives RAID 5 + Spare requires at least 4 physical drives RAID 6 + Spare requires at least 5 physical drives. Using **UP/DOWN** buttons to select RAID level for the volume set and press **ENT** to confirm it.
3	Using **UP/DOWN** buttons to create the current volume set capacity size and press **ENT** to confirm it. The available stripe sizes for the current volume set are displayed.
4	Using **UP/DOWN** buttons to select the current volume set stripe size and press **ENT** key to confirm it. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10(1E), 5 or 6 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size provides better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, choose a small stripe size.
5	When you finished defining the volume set, press **ENT** to confirm the "Quick Volume And Raid Set Setup" function.
6	Press **ENT** to define "FGrnd Init (Foreground initialization)" or press **ESC** to define "BGrnd Init (Background initialization)". When "FGrnd Init", the initialization proceeds must be completed before the volume set ready for system accesses. When "BGrnd Init", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete.
7	Initialize the volume set you have just configured.
8	If you need to add additional volume set, using main menu "Create Volume Set" functions.

4.6 Using Raid Set and Volume Set Functions

In "Raid Set Function", you can use the create RAID set function to generate the new RAID set. In "Volume Set Function", you can use the create volume set function to generate its associated volume set and parameters. If the current SAS RAID subsystem has unused physical devices connected, you can choose the "Create Hot Spare" option in the "Raid Set Function" to define a global hot spare.

Select this method to configure new RAID sets and volume sets. This configuration option allows you to associate volume set with partial and full RAID set.

Step	Action
1	To setup the hot spare (option), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press **ENT** to set the hot spare.
2	Choose "Raid Set Function" from the main menu. Select the "Create Raid Set" and press **ENT**.
3	Select a drive for RAID set from the SAS/SASA/SSD drive connected to the SAS RAID subsystem.
4	Press **UP/DOWN** buttons to select specific physical drives. Press the **ENT** key to associate the selected physical drive with the current RAID set. Recommend use drives has same capacity in a specific RAID set. If you use drives with different capacities in an array, all drives in the RAID set will select the lowest capacity of the drive in the RAID set. The numbers of physical drives in a specific RAID set determine the RAID levels that can be implemented with the RAID set. RAID 0 requires 1 or more physical drives per RAID set. RAID 1 requires at least 2 physical drives per RAID set. RAID 1 + Spare requires at least 3 physical drives per RAID set. RAID 3 requires at least 3 physical drives per RAID set. RAID 5 requires at least 3 physical drives per RAID set. RAID 3 + Spare requires at least 4 physical drives per RAID set. RAID 5 + Spare requires at least 4 physical drives per RAID set. RAID 6 + Spare requires at least 5 physical drives per RAID set.
5	After adding physical drives to the current RAID set as desired, press **ENT** to confirm the "Create Raid Set" function.
6	An edit the RAID set name screen appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for a RAID set. The default RAID set name will always appear as Raid Set. #. Press **ENT** to finish the name editing.

7	Press **ENT** when you are finished creating the current RAID set. To continue defining another RAID set, repeat step 3. To begin volume set configuration, go to step 8.
8	Choose "Volume Set Functions" from the main menu. Select the "Create Volume Set" and press **ENT** .
9	Choose one RAID set from the screen. Press **ENT** to confirm it.
10	The volume set attributes screen appears: The volume set attributes screen shows the volume set default configuration value that is currently being configured. The volume set attributes are: Volume Name, Raid Level, Stripe Size, Cache Mode, SAS Port/SAS LUN Base/SAS LUN, Fibre Port/ Fibre LUN Base/Fibre LUN and iSCSI Target Node/iSCSI LUN and Tagged Queuing. All values can be changed by the user. Press the **UP/DOWN** buttons to select the attributes. Press the **ENT** to modify each attribute of the default value. Using **UP/DOWN** buttons to select attribute value and press the **ENT** to accept the default value.
11	After user completed modifying the attribute, press **ESC** to enter the select capacity for the volume set. Using the **UP/DOWN** buttons to set the volume set capacity and press **ENT** to confirm it.
12	When you finished defining the volume set, press **ENT** to confirm the creation function.
13	Press **ENT** to define "FGrnd Init (Foreground initialization)" or press **ESC** to define "BGrnd Init (Background initialization)". The controller will begin to initialize the volume set, you have just configured. If space remains in the RAID set, the next volume set can be configured. Repeat steps 8 to 13 to configure another volume set.

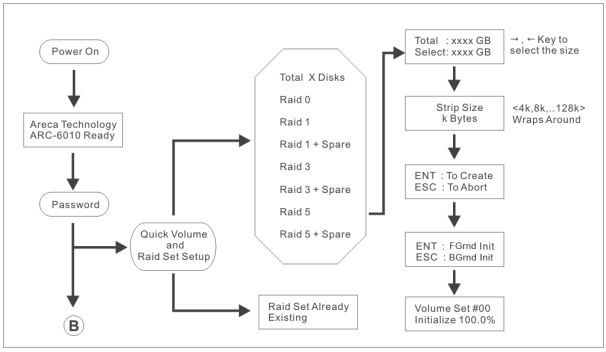
4.7 Navigation Map of the LCD

The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized entry. The RAID subsystem will check the password only when entering the main menu from the initial screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command in five minutes. The RAID subsystem's password is default setting at "**0000**" by the manufacture.

4.7.1 Quick Volume And Raid Setup

"Quick Volume And Raid Setup" is the fastest way to prepare a RAID set and volume set. It only needs a few keystrokes to complete it. Although disk drives of different capacity may be used in the RAID set, it will use the smallest capacity of the disk drive as the capacity of all disk drives in the RAID set. The "Quick Volume And Raid Setup" option creates a RAID set with the following properties:

Figure 4.7.1-1

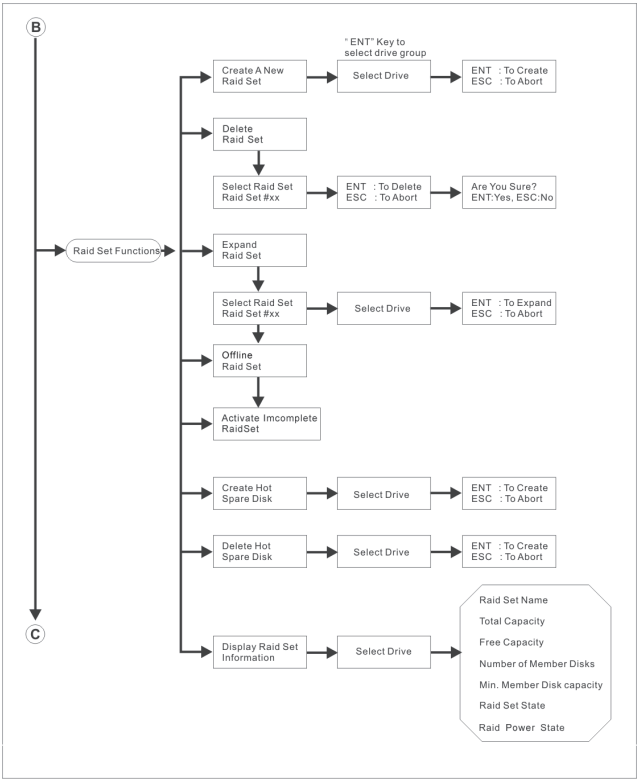


1. All of the physical disk drives are contained in a RAID set.
2. The RAID levels associated with hot spare, capacity, and stripe size are selected during the configuration process.
3. A single volume set is created and consumed all or a portion of the disk capacity available in this RAID set.
4. If you need to add additional volume set, using main menu "Volume Set Functions". Detailed procedure refer to this chapter section 4.7.3.

4.7.2 Raid Set Functions

User manual configuration can complete control of the RAID set setting, but it will take longer time to complete than the "Quick Volume And Raid Setup" configuration. Select the "Raid Set Functions" to manually configure the RAID set for the first time or deletes existing RAID set and reconfigures the RAID set.
To enter a "Raid Set Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Raid Set Functions" option and then press **ENT** to enter further submenus. All RAID set submenus will be displayed.

Figure 4.7.2-1



4.7.2.1 Create A New Raid Set

For detailed procedure please refer to chapter section 4.6.

4.7.2.2 Delete Raid Set

Press **UP/DOWN** buttons to choose the "Delete Raid Set" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to delete and then press **ENT** to accept the RAID set number. The confirmation screen appears, then press **ENT** to accept the delete RAID set function. The double confirmation screen appears, then press **ENT** to make sure of the delete existed RAID set function

4.7.2.3 Expand Raid Set

Instead of deleting a RAID set and recreating it with additional disk drives, the "Expand Existed Raid Set" function allows the user to add disk drives to the RAID set that was created.

To expand existed RAID set, press **UP/DOWN** buttons to choose the "Expand Raid Set" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to expand and then press **ENT** to accept the RAID set number. If there is an available disk, then the "Select Drive" appears. Using **UP/DOWN** buttons to select the target disk and then press **ENT** to select it. Press **ENT** to start expanding the existed RAID set. The new added capacity can defined one or more volume sets. Follow the instruction presented in the "Volume Set Function" to create the volume sets.

Migrating occurs when a disk is added to a RAID set. Migration status is displayed in the RAID status area of the "Raid Set information" when a disk is added to a RAID set. Migrating status is also displayed in the associated volume status area of the volume set information when a disk is added to a RAID set.

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.

4.7.2.4 Offline Raid Set

Press **UP/DOWN** buttons to choose the "Offline Raid Set" option. This function is for customer being able to unmount and remount a multi-disk volume. All hdds of the selected RAID set will be put into offline state, spun down and fault LED will be in fast blinking mode.

4.7.2.5 Activate Incomplete RaidSet

When one of the disk drive is removed or loosed connection in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work, when the RAID subsystem is power on. User can use the "Activate Incomplete RaidSet" option to active the RAID set. After user completed the function, the "Raid State" will change to "Degraded Mode".

4.7.2.6 Create Hot Spare Disk

Please refer to this chapter section 4.4. Designating drives as hot spares.

4.7.2.7 Delete Hot Spare Disk

To delete hot spare, press **UP/DOWN** buttons to choose the "Delete Hot Spare Disk" option. Using **UP/DOWN** buttons to select the hot spare number that user wants to delete and then press **ENT** to select it. The confirmation screen appears and press **ENT** to delete the hot spare.

4.7.2.8 Display Raid Set Information

Choose the "Display Raid Set Information" option and press **ENT**. Using **UP/DOWN** buttons to select the RAID set number. Then the RAID set information will be displayed.

Using **UP/DOWN** buttons to see the RAID set information, it will show Raid Set Name, Total Capacity, Free Capacity, Number of Member Disks, Min. Member Disk Capacity, Raid Set State and Raid Power Status.

4.7.3 Volume Set Functions

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of the disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set. Additional volume sets created in a specified RAID set will reside on all the physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set.

To enter the "Volume Set Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Volume Set Functions" option and then press **ENT** to enter further submenus. All volume set submenus will be displayed.

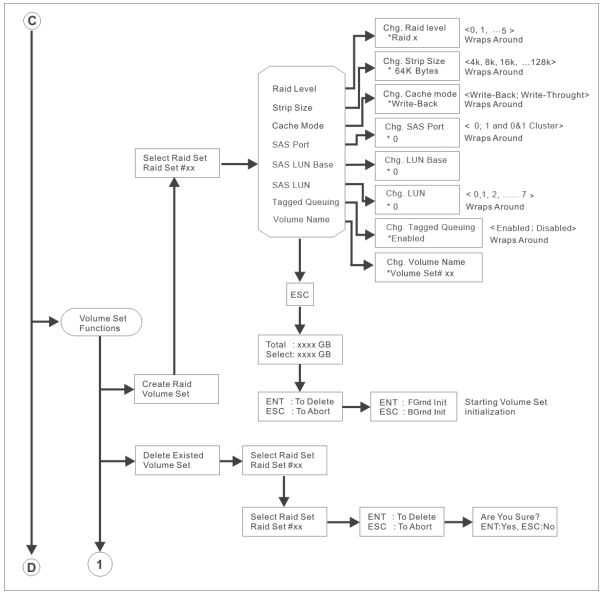


Figure 4.7.3.1-1

4.7.3.1 Create Raid Volume Set

To create a volume set, please refer to this chapter section 4.7, using "Raid Set Functions"and "Volume Set Functions". The volume set attributes screen shows the volume set default configuration values that have currently being configured.

The attributes for RAID subsystem series are Volume Name, Raid Level, Stripe Size, Cache Mode, SAS Port/ SAS LUN Base/ SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN and Tagged Queuing. See Figure 4.7.3.1-1

All values can be changed by user. Press the **UP/DOWN** buttons to select attributes. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the default value. The following is the attributes descriptions. Please refer to this chapter section 4.7 using "Raid Set Functions" and "Volume Set Functions" to complete the create volume set function.

4.7.3.1.1 Volume Name

The default volume name will always appear as volume set #. You can rename the volume set name providing it does not exceed the 15 characters limit.

4.7.3.1.2 Raid Level

The RAID subsystem can only set the RAID level 0, 1, 10(1E), 3, 5 and 6 on the LCD configuration.

4.7.3.1.3 Stripe Size

This parameter sets the size of the segment written to each disk in a RAID 0, 1, 10(1E), 5 or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.

A larger stripe size produces better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a small stripe size.

4.7.3.1.4 Cache Mode

User can set the cache mode as "Write-Through" or "Write-Back ".

4.7.3.1.5 SAS Port/SAS LUN Base/SAS LUN

SAS Port: Two 4-PHY links SAS ports can be applied to the RAID subsystem. The RAID subsystem supports Port 0,1 and 0&1 Cluster option.

SAS LUN base: Each SAS device attached to the SAS host adapter must be assigned a unique SAS ID number. A SAS port can connect up to 128(16*8) volume sets. The RAID subsystem is as a large SAS device. We should assign an LUN base from a list of SAS LUN Base.

SAS LUN: Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.

- **Fibre Port/Fibre LUN Base/Fibre LUN**

Fibre Port: Four 8Gbps Fibre channel can be applied to the SAS RAID subsystem. Choose the Fibre Host: "0", "1" or "0&1 Cluster" option. A "Select Fibre Channel" appears, select the channel number and press **ENT** key to confirm it.

Fibre LUN Base: Each fibre device attached to the Fibre card, as well as the card itself, must be assigned a unique fibre ID number. A Fibre channel can connect up to 128(16*8) volume sets. The RAID subsystem is as a large Fibre device. We should assign an LUN base from a list of Fibre LUN Base.

Fibre LUN: Each Fibre LUN base can support up to 8 LUNs. Most Fibre channel host adapter treats each LUN like a Fibre disk.

- **iSCSI Target Node/iSCSI LUN**

iSCSI Target Node: A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/SATA device. We should assign a Node from a list of Target Node. A iSCSI channel can connect up to 128(16*8) volume sets.

iSCSI LUN: Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.

4.7.3.1.6 Tagged Queuing

The "Enabled" option is useful for enhancing overall system performance under multi-tasking operating systems. The Tagged Command Queuing (TCQ) function controls the SAS command tag queuing support for each drive channel. This function should normally remain enabled. Disable this function only when using older SAS drives that do not support command tag queuing.

4.7.3.1.7 Initialization Mode

Press **ENT** to define "FGrnd Init (Foreground initialization)" or press **ESC** to define "BGrnd Init (Background initialization)". When "FGrnd Init", the initialization proceeds must be completed before the volume set ready for system accesses. When "BGrnd Init", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete.

4.7.3.2 Delete Existed Volume Set

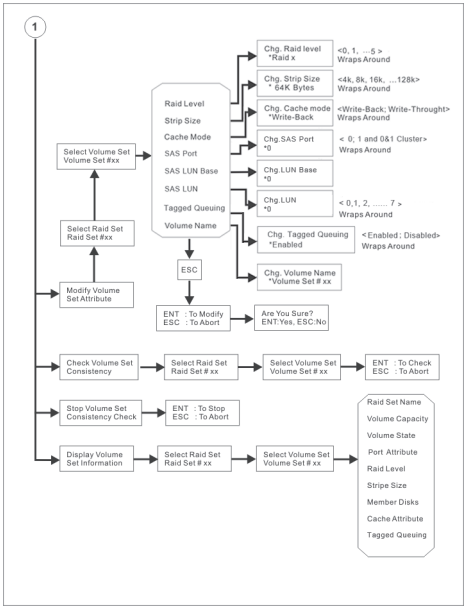
Choose the "Delete Existed Volume Set" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to delete and press **ENT**. The confirmation screen appears, and then press **ENT** to accept the delete volume set function. The double confirmation screen appears, then press **ENT** to make sure of the delete existed volume set.

4.7.3.3 Modify Volume Set Attribute

Use this option to modify volume set configuration. To modify volume set attributes from RAID set system function, press **UP/DOWN** buttons to choose the "Modify Volume Set Attribute" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to modify and press **ENT**.

Press **ENT** to select the existed volume set attribute. The volume set attributes screen shows the volume set setting configuration attributes that were currently being configured. The attributes are Raid Level, Stripe Size, Cache Mode, SAS Port/ SAS LUN Base/SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN and Tagged Queuing and Volume Name (number). All values can be modified by user. Press the **UP/DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press the **ENT** to accept the selection value. Choose this option to display the properties of the selected volume set.

Figure 4.7.3.2-1



4.7.3.3.1 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, a volume set strip size changes, or when a disk is added to a RAID set. Migration status is displayed in the volume state area of the "Display Volume Set" Information.

4.7.3.4 Check Volume Set Consistency

Use this option to check volume set consistency. To check volume set consistency from volume set system function, press **UP/DOWN** buttons to choose the "Check Volume Set Consistency" option. Using **UP/DOWN** button to select the RAID set number that user wants to check and press E**NT**. The confirmation screen appears, press **ENT** to start the check volume set consistency.

4.7.3.5 Stop Volume Set Consistency Check

Use this option to stop volume set consistency check. To stop volume set consistency check from volume set system function, press **UP/DOWN** buttons to choose the "Stop Volume Set Consistency Check" option and then press **ENT** to stop the check volume set consistency.

4.7.3.6 Display Volume Set Information

To display volume set information from volume set function, press **UP/DOWN** buttons to choose the "Display Volume Set Information" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to show and press **ENT**. The volume set information will show Volume Set Name, Raid Set Name, Volume Capacity, Port Attribute, RAID Level, Stripe Size, Member Disks, Cache Attribute and Tagged Queuing. All values can not be modified by this option.

4.7.4 Physical Drive Functions

Choose this option from the main menu to select a physical disk and to perform the operations listed below. To enter a physical drive functions, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Physical Drive Functions" option and then press **ENT** to enter further submenus. All physical drive submenus will be displayed.

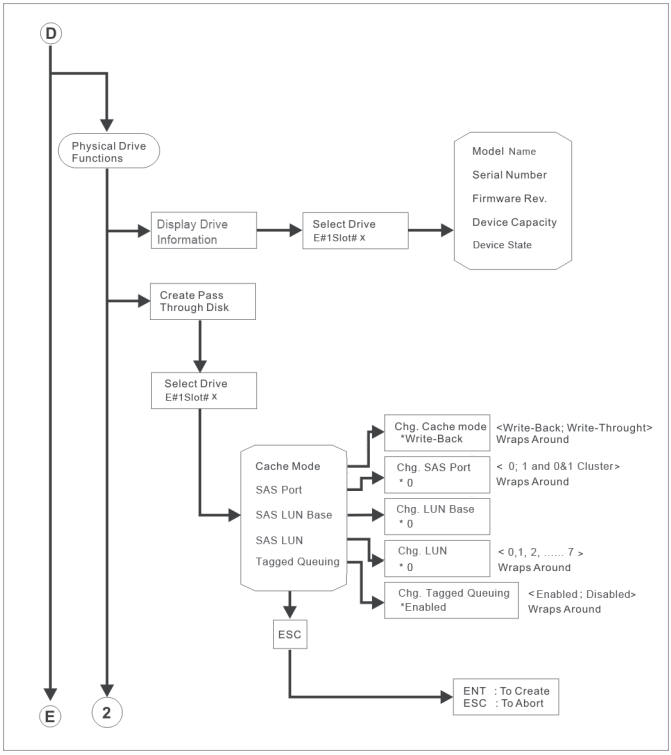


Figure 4.7.4-1

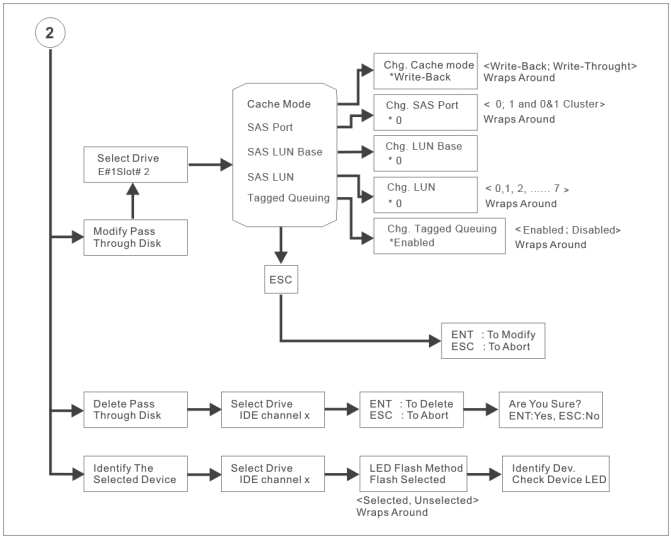


Figure 4.7.4-2

4.7.4.1 Display Drive Information

Using **UP/DOWN** buttons to choose the "Display Drive Information" option and press **ENT**. Using **UP/DOWN** buttons to select the drive SAS/SATA number that user want to display. The drive information will be displayed. The SATA drive information screen shows the Model Name, Serial Number, Firmware Rev., Device Capacity, Current SATA, Supported SATA, and Device State.

4.7.4.2 Create Pass-Through Disk

Disk is not controlled by the RAID subsystem's firmware and thus can not be a part of a RAID set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID subsystem's firmware. Using **UP/DOWN** buttons to choose the "Create Pass-Through Disk" option and press **ENT**. Using **UP/DOWN** buttons to select the drive SAS/SATA number that user want to create. The drive attributes will be displayed.

The attributes for pass-through disk show the Volume Cache Mode, SAS Port/ SAS LUN Base/SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/iSCSI LUN and Tagged Queuing .

All values can be changed by user. Press the **UP/DOWN** buttons to attribute and then press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the selection value.

4.7.4.3 Modify Pass-Through Disk

To modify pass-through disk attributes from pass-through drive pool, press **UP/DOWN** buttons to choose the "Modify Pass-Through Disk" option, and then press **ENT**. The select drive function menu will show all pass-through disk number items. Using **UP/DOWN** buttons to select the pass-through disk that user wants to modify and press **ENT**. The attributes screen shows the pass through disk setting values that were currently being configured.
The attributes for pass-through disk are the Volume Cache

Mode, Tagged Command Queuing and SAS Port/ SAS LUN Base/ SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN. All values can be modified by user. Using **UP/ DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the selection value. After completing the modification, press **ESC** to enter the confirmation screen and then press **ENT** to accept the "Modify Pass-Through Disk" function.

4.7.4.4 Delete Pass-Through Disk

To delete pass through disk from the pass-through drive pool, press **UP/DOWN** buttons to choose the "Delete Pass-Through Disk" option, and then press **ENT**. The "Select Drive Function" menu will show all pass-through disk number items. Using **UP/ DOWN** buttons to select the pass-through disk that user wants to delete and press **ENT**. The delete pass-through confirmation screen will appear, press **ENT** to delete it.

4.7.4.5 Identify The Selected Drive

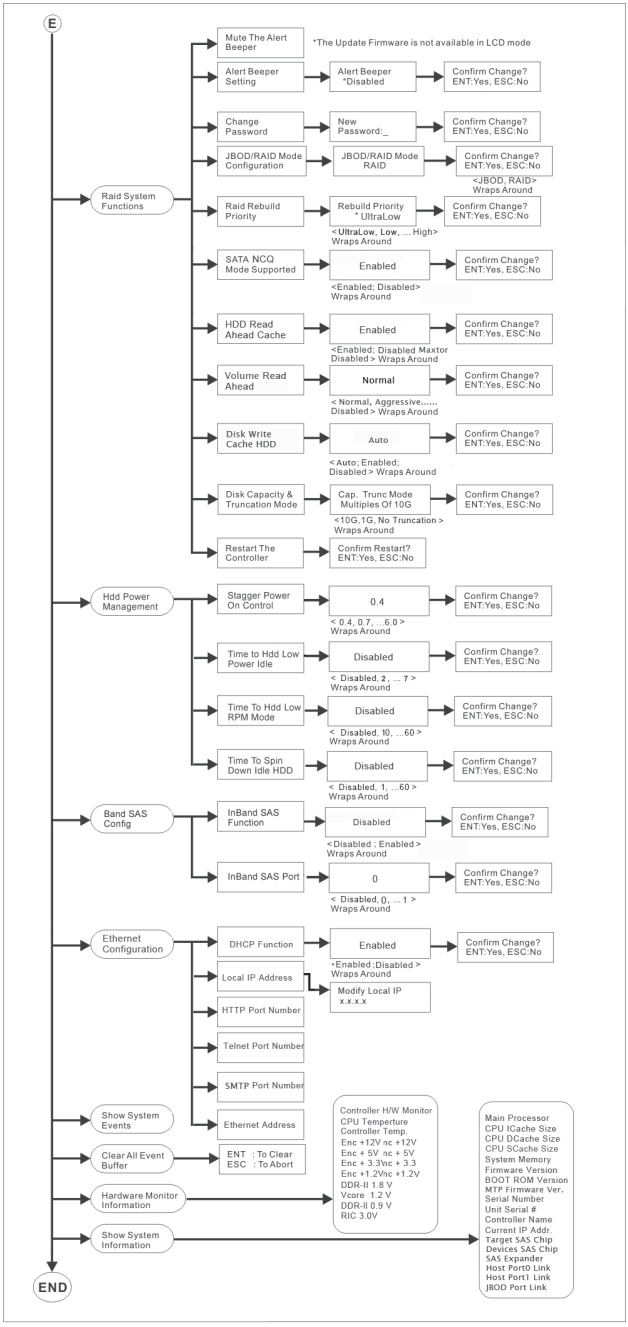
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify The Selected Drive" function is selected.
To identify selected drive from the physical drive pool, press **UP/DOWN** buttons to choose the "Identify The Selected Drive" option, then press **ENT** key. The "Select Drive function "menu will show all physical drive number items. Using **UP/DOWN** buttons to select the disk that user want to identify and press **ENT**. The selected disk fault LED indicator will flash.

4.7.5 Raid System Functions

To enter a "Raid System Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Raid System Functions" option and then press **ENT** to enter further submenus. All RAID system submenus will be displayed. Using **UP/DOWN** buttons to select the submenus option and then press **ENT** to enter the selection function.

LCD CONFIGURATION MENU

Figure 4.7.5-1



4.7.5.1 Mute The Alert Beeper

The "Mute The Alert Beeper" function item is used to control the RAID subsystem beeper. Select **No** and press **ENT** button to turn the beeper off temporarily. The beeper will still activate on the next event.

4.7.5.2 Alert Beeper Setting

The "Alert Beeper Setting" function item is used to disable or enable the RAID subsystem's alarm tone generator. Using the **UP/DOWN** buttons to select "Alert beeper Setting" and press **ENT** to accept the selection. After completed the selection, the confirmation screen will be displayed and then press **ENT** to accept the function. Select the "Disabled" and press **ENT** key in the dialog box to turn the beeper off.

4.7.5.3 Change Password

To set or change the RAID subsystem's password, press the **UP/DOWN** buttons to select "Change Password" option and then press **ENT** to accept the selection. The "New Password:" screen appears and enter new password that users want to change. Using **UP/DOWN** buttons to set the password value. After completed the modification, the confirmation screen will be displayed and then press **ENT** to accept the function. To disable the password, press **ENT** only in the "New Password:" column. The existing password will be cleared. No password checking will occur when entering the main menu from the starting screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command in 5 minutes. Do not use spaces when you enter the password, If spaces are used, it will lock out the user.

4.7.5.4 JBOD/RAID Mode Configuration

JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

4.7.5.5 Raid Rebuild Priority

The "Raid Rebuild Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows user to choose the rebuild priority (UltraLow, Low, ... High) to balance volume set access and rebuild tasks appropriately. To set or change the RAID subsystem's RAID rebuild priority, press the **UP/DOWN** buttons to select "RAID Rebuild Priority" and press **ENT** to accept the selection. The rebuild priority selection screen appears and uses the **UP/DOWN** buttons to set the rebuild value. After completing the modification, the confirmation screen will be displayed and then press **ENT** to accept the function.

4.7.5.6 SATA NCQ Mode Support

The controller supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".

4.7.5.7 HDD Read Ahead Cache

Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.

4.7.5.8 Volume Data Read Ahead

The data read ahead parameter specifies the controller firmware algorithms which process the "Data Read Ahead" blocks from the disk. The read ahead parameter is normal by default. To modify the value, you must know your application behavior. The default "Normal" option satisfies the performance requirements for a typical volume. The "Disabled" value implies no read ahead. The most efficient value for the controllers depends on your

application. "Aggressive" read ahead is optimal for sequential access but it degrades random access.

4.7.5.9 Disk Write Cache HDD

User can set the "Disk Write Cache Mode" to "Auto", "Enabled", or "Disabled". "Enabled" increases speed, "Disabled" increases reliability.

4.7.5.10 Disk Capacity Truncation Mode

The RAID subsystem uses drive truncation so that drives from differing vendors are more likely to be able to be used as spares for each other. Drive truncation slightly decreases the usable capacity of a drive that is used in redundant units. The RAID subsystem provides three truncation modes in the system configuration: Multiples Of 10G, Multiples Of 1G and Disabled.

Multiples Of 10G: If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. "Multiples Of 10G" truncates the number under tens. This makes the same capacity for both of these drives so that one could replace the other.

Multiples Of 1G: If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. "Multiples Of 1G" truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other.

Disabled: It does not truncate the capacity.

4.7.5.11 Restart Controller

To restart the RAID controller, press **UP/DOWN** buttons to select "Restart Controller" and then press **ENT** to accept the selection. The confirmation screen will be displayed and then press **ENT** to accept the function.

Note:

It can only work properly at host and drive without any activity.

4.7.6 Hdd Power Management

Areca has automated the ability to manage HDD power based on usage patterns. The "HDD Power Management" allows you to choose a "Stagger Power On Control", "Low Power Idle", "Low RPM" and completely "Spins Down Idle HDD". It is designed to reduce power consumption and heat generation on idle drives.

4.7.6.1 Stagger Power On Control

In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.

4.7.6.2 Time to Hdd Low Power Idle

This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.

4.7.6.3 Time To Hdd Low RPM Mode

This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.

4.7.6.4 Time To Spin Down Idle HDD

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.

4.7.7 In Band SAS Config

The RAID manager supports both in-band and out-of-band management to control the disk array subsystem. In-band management refers to management of the SAS disk array from a SAS host management transactions traverse the SAS bus. Out-of-band management refers to management of the disk array from a remote station connected to the controller either via a RS-232 or through a LAN port. In-band management is simpler than out-of-band management for it requires less hardware in its configuration.

Since the host adapter is already installed in the host system, no extra connection is necessary. Just load the necessary in-band driver for the controller and then combine the API with user's RAID manager from the local host to start management of the disk array system.

4.7.7.1 InBand SAS Function

The RAID subsystem reserves one LUN for In-band management transactions. This option is for user to release the LUN when In-band management is not enabled.

4.7.7.2 InBand SAS Port

Since the SAS RAID controller supports two SAS host ports, the In-band can through either SAS port 0 or port 1.

4.7.8 Ethernet Configuration

To configuration Ethernet function, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the option.

4.7.8.1 DHCP

DHCP (Dynamic Host Configuration Protocol) allows network administrators centrally manage and automate the assignment of IP (Internet Protocol) addresses on a computer network. When using the TCP/IP protocol (Internet protocol), it is necessary for a computer to have a unique IP address in order to communicate to other computer systems. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select DHCP, then press **ENT**.

Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with other devices on the network.

4.7.8.2 Local IP Adress

If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address alloca-

tion scheme will reduce the time it takes to set-up client computers and eliminate the possibilities of administrative errors and duplicate addresses. To manually configure the IP address of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "Local IP Adress", then press **ENT**. It will show the default address setting in the RAID subsystem You can then reassign the static IP address of the RAID subsystem.

4.7.8.3 HTTP Port Number

To manually configure the "HTTP Port Number" of the RAID subsystem, press **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "HTTP Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. Then You can reassign the default "HTTP Port Number" of the controller.

4.7.8.4 Telnet Port Number

To manually configure the "Telent Port Number" of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "Telent Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. You can then reassign the default "Telent Port Number" of RAID subsystem.

4.7.8.5 SMTP Port Number

To manually configure the "SMTP Port Number" of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "SMTP Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. You can then reassign the default "SMTP Port Number" of RAID subsystem.

4.7.8.6 Ethernet Address

Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet Address is used to uniquely identify a port in the Ethernet network.

4.7.9 Show System Events

To view the RAID subsystem events, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Show System Events" option, and then press **ENT**. The system events will be displayed. Press **UP/DOWN** buttons to browse all the system events.

4.7.10 Clear all Event Buffers

Use this feature to clear the entire events buffer information. To clear all event buffers, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Clear all Event Buffers" option, and then press **ENT**. The confirmation message will be displayed and press **ENT** to clear all event buffers or **ESC** to abort the action.

4.7.11 Hardware Monitor Information

To view the RAID subsystem monitor information, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Hardware Information" option, and then press **ENT**. All hardware monitor information will be displayed. Press **UP/DOWN** buttons to browse all the hardware information. The hardware information provides the CPU temperature, controller temperature, fan speed (chassis fan), battery status and voltage of the RAID subsystem. All items are also unchangeable. The warning messages will indicate through the LCD, LED and alarm buzzer.

4.7.12 System Information

Choose this option to display Main processor, CPU instruction cache size, CPU data cache size, system memory, firmware version, BOOT ROM version, MTP firmware, serial number, unit serial, controller name, current IP, target SAS chip, devices chip,

SAS expander, host port link and JBOD port link. To check the system information, press **ENT** to enter the main menu. Press **UP/DOWN** button to select the "Show System Information" option, and then press **ENT**. All major controller system information will be displayed. Press **UP/DOWN** buttons to browse all the system information.

5. VT-100 Utility Configuration

The RAID subsystem configuration utility is firmware-based and uses to configure RAID sets and volume sets. Because the utility resides in the RAID subsystem's firmware, its operation is independent of the operating systems on your computer. Use this utility to:

- Create RAID set,
- Expand RAID set,
- Define volume set,
- Add physical drive,
- Modify volume set,
- Modify RAID level/stripe size,
- Define pass-through disk drives,
- Update firmware,
- Modify system function and
- Designate drives as hot spares.

Keyboard Navigation

The following definition is the VT-100 RAID configuration utility keyboard navigation

Key	Function
Arrow Key	Move Cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line Draw
X Key	Redraw

5.1 Configuring Raid Sets/Volume Sets

You can configure RAID sets and volume sets with VT-100 utility configuration automatically. Using “Quick Volume/Raid Setup” or manually using “Raid Set/Volume Set Function”. Each configuration method requires a different level of user input. The general flow of operations for RAID set and volume set configuration is:

Step	Action
1	Designate hot spares/pass-through (optional).
2	Choose a configuration method.
3	Create RAID sets using the available physical drives.
4	Define volume sets using the space in the RAID set.
5	Initialize the volume sets (logical drives) and use volume sets in the host OS.

5.2 Designating Drives as Hot Spares

Any unused disk drive that is not part of a RAID set can be designated as a hot spare. The "Quick Volume/Raid Setup" configuration will add the spare disk drive and automatically display the appropriate RAID level from which the user can select. For the "Raid Set Function" configuration option, the user can use the "Create Hot Spare" option to define the hot spare disk drive.

When a hot spare disk drive is being created using the "Create Hot Spare" option (in the "Raid Set Function"), all unused physical devices connected to the current controller appear:
Choose the target disk by selecting the appropriate check box.
Press **Enter** key to select a disk drive, and press **Yes** in the "Create Hot Spare" to designate it as a hot spare.

5.3 Using Quick Volume /Raid Setup Configuration

"Quick Volume / Raid Setup configuration" collects all available drives and includes them in a RAID set. The RAID set you created is associated with exactly one volume set. You will only be able to modify the default RAID level, stripe size and capacity of the new volume set. Designating drives as hot spares is also possible in the "Raid Level" selection option. The volume set default settings will be:

Parameter	Setting
Volume Name	Volume Set # 00
SAS Port#/LUN Base/LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

VT-100 UTILITY CONFIGURATION

The default setting values can be changed after configuration is complete. Follow the steps below to create arrays using "Quick Volume / Raid Setup" configuration:

Step	Action
1	Choose "Quick Volume /Raid Setup" from the main menu. The available RAID levels with hot spare for the current volume set drive are displayed.
2	It is recommended that you use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will be set to the capacity of the smallest drive in the RAID set. The numbers of physical drives in a specific array determines which RAID levels that can be implemented in the array. RAID 0 requires 1 or more physical drives. RAID 1 requires at least 2 physical drives. RAID 10(1E) requires at least 3 physical drives. RAID 3 requires at least 3 physical drives. RAID 5 requires at least 3 physical drives. RAID 3 +Spare requires at least 4 physical drives. RAID 5 + Spare requires at least 4 physical drives. RAID 6 requires at least 4 physical drives. RAID 6 + Spare requires at least 5 physical drives. Highlight the desired RAID level for the volume set and press the **Enter** key to confirm.
3	The capacity for the current volume set is entered after highlighting the desired RAID level and pressing the **Enter** key. The capacity for the current volume set is displayed. Use the **UP** and **DOWN** arrow keys to set the capacity of the volume set and press the **Enter** key to confirm. The available stripe sizes for the current volume set are then displayed.
4	Use the **UP** and **DOWN** arrow keys to select the current volume set stripe size and press the **Enter** key to confirm. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10(1E), 5 or 6 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size provides better read performance, especially when the computer performs mostly sequential reads. However, if the computer performs random read requests more often, choose a smaller stripe size.
5	When you are finished defining the volume set, press the **Yes** key to confirm the "Quick Volume And Raid Set Setup" function.
6	Foreground (Fast Completion) Press **Enter** key to define fast initialization or selected the Background (Instant Available) or No Init (To Rescue Volume). In the "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. In "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. In "No Init", there is no initialization on this volume.

7	Initialize the volume set you have just configured
8	If you need to add additional volume set, using main menu "Create Volume Set" function.

5.4 Using Raid Set/Volume Set Function Method

In "Raid Set Function", you can use the "Create Raid Set" function to generate a new RAID set. In "Volume Set Function", you can use the "Create Volume Set" function to generate an associated volume set and configuration parameters.

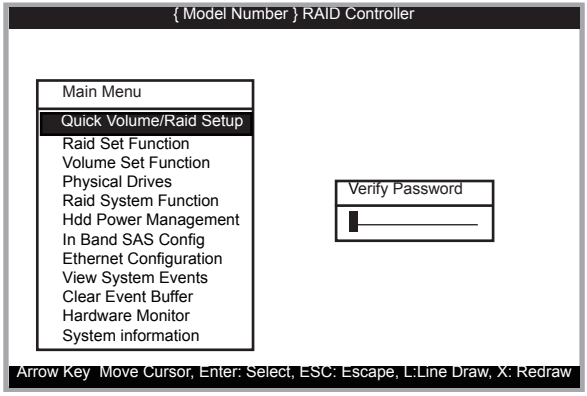
If the current controller has unused physical devices connected, you can choose the "Create Hot Spare" option in the "Raid Set Function" to define a global hot spare. Select this method to configure new RAID sets and volume sets. The "Raid Set/Volume Set Function" configuration option allows you to associate volume sets with partial and full RAID sets.

Step	Action
1	To setup the hot spare (option), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press the **Enter** key to define the hot spare.
2	Choose "RAID Set Function" from the main menu. Select "Create Raid Set" and press the **Enter** key.
3	The "Select a Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the RAID subsystem.
4	Press the **UP** and **DOWN** arrow keys to select specific physical drives. Press the **Enter** key to associate the selected physical drive with the current RAID set. It is recommended that you use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will be set to the capacity of the smallest drive in the RAID set. The numbers of physical drives in a specific array determines which RAID levels that can be implemented in the array. RAID 0 requires 1 or more physical drives. RAID 1 requires at least 2 physical drives. RAID 10(1E) requires at least 3 physical drives. RAID 3 requires at least 3 physical drives. RAID 5 requires at least 3 physical drives. RAID 6 requires at least 4 physical drives. RAID 30 requires at least 6 physical drives. RAID 50 requires at least 6 physical drives. RAID 60 requires at least 8 physical drives.

5	After adding the desired physical drives to the current RAID set, press the **Enter** to confirm the "Create Raid Set" function.
6	An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for this new RAID set. The default RAID set name will always appear as Raid Set. #. Press **Enter** to finish the name editing.
7	Press the **Enter** key when you are finished creating the current RAID set. To continue defining another RAID set, repeat step 3. To begin volume set configuration, go to step 8.
8	Choose the "Volume Set Function" from the main menu. Select "Create Volume Set" and press the **Enter** key.
9	Choose a RAID set from the "Create Volume From Raid Set" window. Press the **Yes** key to confirm the selection.
10	Choosing Foreground (Fast Completion) Press **Enter** key to define fast initialization or selected the Background (Instant Available) or No Init (To Rescue Volume). In the "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. In "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. In "No Init", there is no initialization on this volume.
11	If space remains in the RAID set, the next volume set can be configured. Repeat steps 8 to 10 to configure another volume set.

5.5 Main Menu

The main menu shows all functions that are available for executing actions, which is accomplished by clicking on the appropriate link.



Note:

The manufacture default password is set to 0000, this password can be selected by the "Change Password" in the section of "Raid System Function".

Option	Description
Quick Volume/Raid Setup	Create a default configuration which based on numbers of physical disk installed
Raid Set Function	Create a customized RAID set
Volume Set Function	Create a customized volume set
Physical Drives	View individual disk information
Raid System Function	Setting the RAID system configuration
In Band SAS Config	In Band management configuration
Ethernet Configuration	LAN port setting
View System Events	Record all system events in the buffer
Clear Event Buffer	Clear all event buffer information
Hardware Monitor	Show all system environment status
System Information	View the controller information

This password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the internal RAID subsystem from unauthorized entry. The controller will prompt for the password only when entering the main menu from the initial screen. The RAID subsystem will automatically return to the initial screen when it does not receive any command in five minutes.

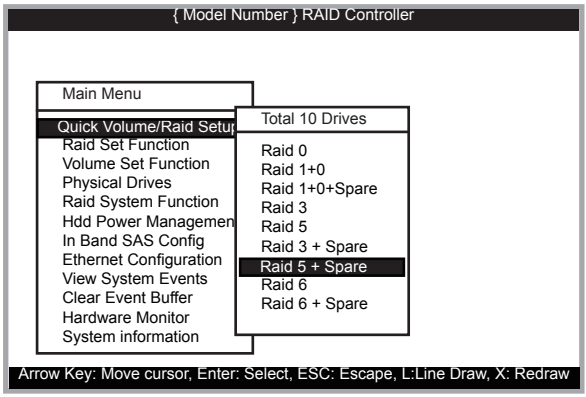
5.5.1 Quick Volume/Raid Setup

"Quick Volume/RAID Setup" is the fastest way to prepare a RAID set and volume set. It requires only a few keystrokes to complete. Although disk drives of different capacity may be used in the RAID Set, it will use the capacity of the smallest disk drive as the capacity of all disk drives in the RAID Set. The "Quick Volume/RAID Setup" option creates a RAID set with the following properties:

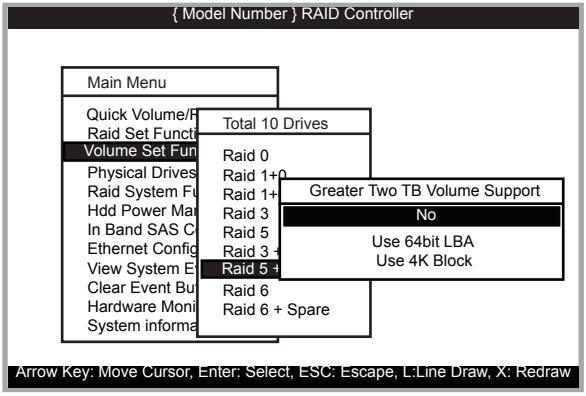
1. All of the physical drives are contained in one RAID set.
2. The RAID level, hot spare, capacity, and stripe size options are selected during the configuration process.
3. When a single volume set is created, it can consume all or

a portion of the available disk capacity in this RAID set.
4. If you need to add an additional volume set, use the main menu "Create Volume Set" function.

The total number of physical drives in a specific RAID set determine the RAID levels that can be implemented within the RAID set. Select "Quick Volume/Raid Setup" from the main menu; all possible RAID level will be displayed on the screen.



If volume capacity will exceed 2TB, controller will show the "Greater Two TB Volume Support" sub-menu.



- **No**

It keeps the volume size with max. 2TB limitation.

• 64bit LBA

This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity up to 512TB.

This option works on different OS which supports 16 bytes CDB. Such as:
Windows 2003 with SP1 or later
Linux kernel 2.6.x or later

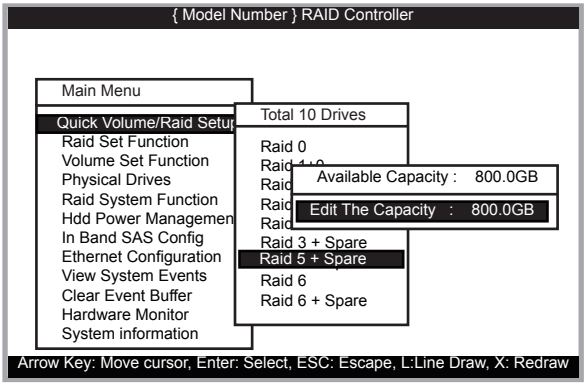
• 4K Block

It changes the sector size from default 512 Bytes to 4k Bytes. The maximum volume capacity up to 16TB.

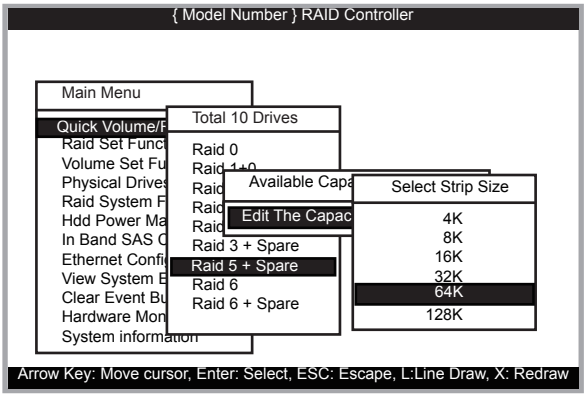
This option works under Windows platform only. And it can not be converted to "Dynamic Disk", because 4k sector size is not a standard format.

For more details, please download pdf file from **ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/Over2TB_050721.zip**

A single volume set is created and consumes all or a portion of the disk capacity available in this RAID set. Define the capacity of volume set in the "Available Capacity" popup. The default value for the volume set, which is 100% of the available capacity, is displayed in the selected capacity. use the **UP** and **DOWN** arrow key to set capacity of the volume set and press **Enter** key to accept this value. If the volume set uses only part of the RAID set capacity, you can use the "Create Volume Set" option in the main menu to define additional volume sets.

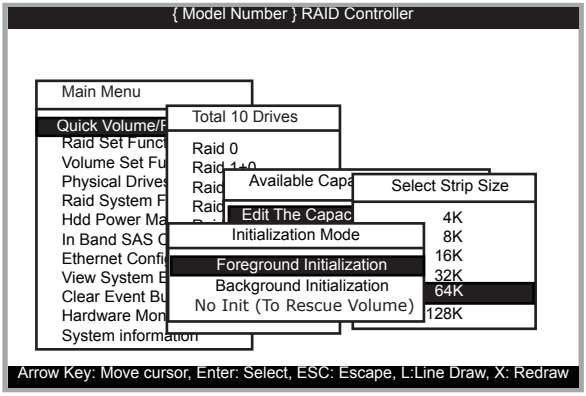


Stripe Size This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.



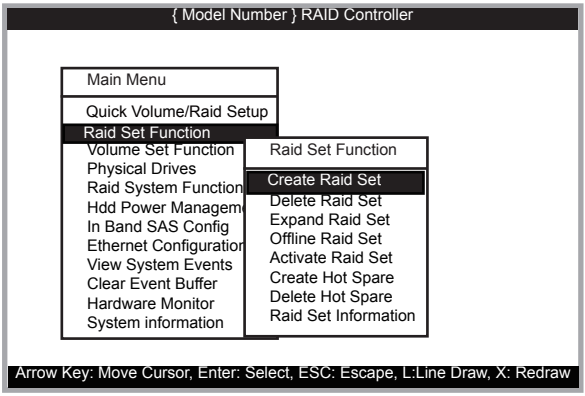
A larger stripe size produces better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer performs random reads more often, select a smaller stripe size.

Press **Yes** option in the "Create Vol/Raid Set" dialog box, the RAID set and volume set will start to initialize it.
Select "Foreground (Faster Completion)" or "Background (Instant Available)" for initialization or "No Init (To Rescue Volume)" for recovering the missing RAID set configuration.



5.5.2 Raid Set Function

Manual configuration gives complete control of the RAID set setting, but it will take longer to configure than "Quick Volume/ Raid Setup" configuration. Select "Raid Set Function" to manually configure the RAID set for the first time or delete existing RAID sets and reconfigure the RAID set.



5.5.2.1 Create Raid Set

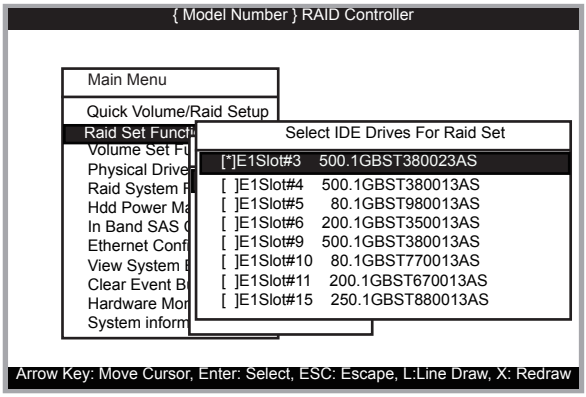
The following is the RAID set features for the RAID subsystem.

1. Up to 32 disk drives can be included in a single RAID set.
2. Up to 128 RAID sets can be created per controller. RAID level 30 50 and 60 can support up to eight sub-volumes (RAID set).

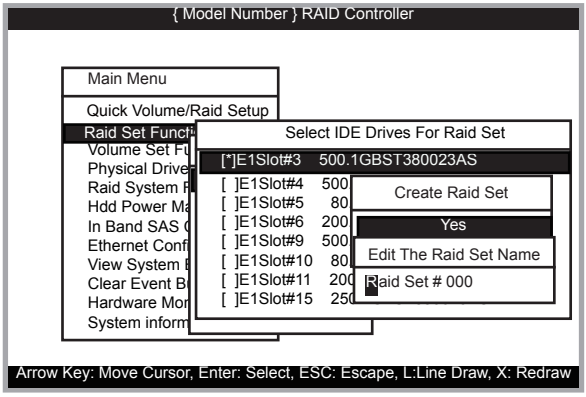
To define a RAID set, follow the procedures below:
1. Select "Raid Set Function" from the main menu.
2. Select "Create Raid Set " from the "Raid Set Function" dialog box.
3. A "Select IDE Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the current controller. Press the **UP** and **DOWN** arrow keys to select specific physical drives. Press the **Enter** key to associate the selected physical drive with the current RAID set. Repeat this step; the user can add as many disk drives as are available to a single RAID set.

When finished selecting SAS/SATA drives for RAID set, press **Esc** key. A "Create Raid Set Confirmation" screen will appear, select the **Yes** option to confirm it.

4. An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for the RAID set. The default RAID set name will always appear as Raid Set. #.



5. Repeat steps 3 and 4 to define another RAID set.

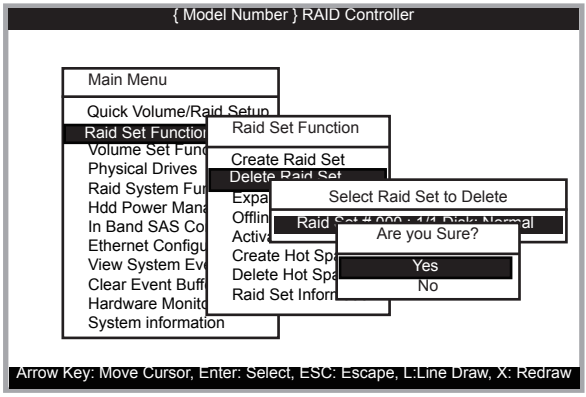


Note:

1. You can only edit the Raid set name in "Create Raid Set".
2.To create RAID 30/50/60 volume, you need to create multiple RAID sets first with the same disk members on each RAID set. The max no. disk drives per volume set: 32 for RAID 0/1/10(1E)/3/5/6 and 128 for RAID 30/50/60.

5.5.2.2 Delete Raid Set

To completely erase and reconfigure a RAID set, you must first delete it and re-create the RAID set. To delete a RAID set, select the RAID set number that you want to delete in the "Select Raid Set To Delete" screen. Then "Delete Raid Set" dialog box will appear, press the **Yes** to delete it. Warning, data on RAID set will be lost if this option is used. But for deleting RAID set with the Raid 30/50/60 volume, firstly, you need to delete the volumes belonging those RAID sets.



5.5.2.3 Expand Raid Set

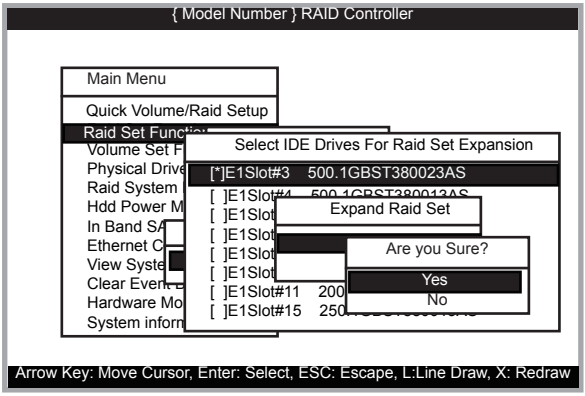
Instead of deleting a RAID set and recreating it with additional disk drives, the "Expand Raid Set" function allows the users to add disk drives to the RAID set that have already been created. To expand a RAID set:

Select the "Expand Raid Set" option. If there is an available disk, then the "Select SATA Drives For Raid Set Expansion" screen appears.

Select the target RAID set by clicking on the appropriate radius button. Select the target disk by clicking on the appropriate check box.

Press the **Yes** key to start the expansion on the RAID set.

The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set " to modify the volume sets; operation system specific utilities may be required to expand operating system partitions.

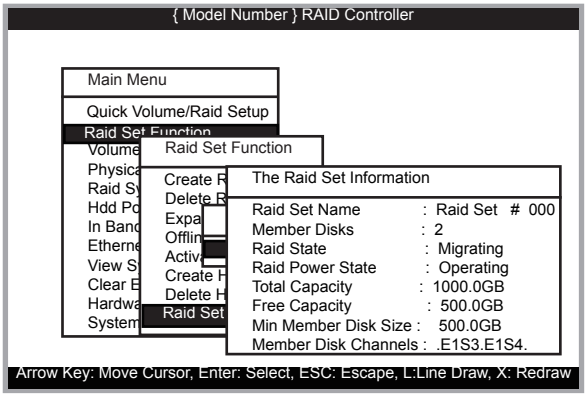

{ Model Number } RAID Controller
Main Menu
Quick Volume/Raid Setup
Select IDE Drives For Raid Set Expansion
[*]E1Slot#3 500.1GBST380023AS
Expand Raid Set
Are you Sure?
Yes
No
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID 30/50/60 doesn't support the "Expand Raid Set".

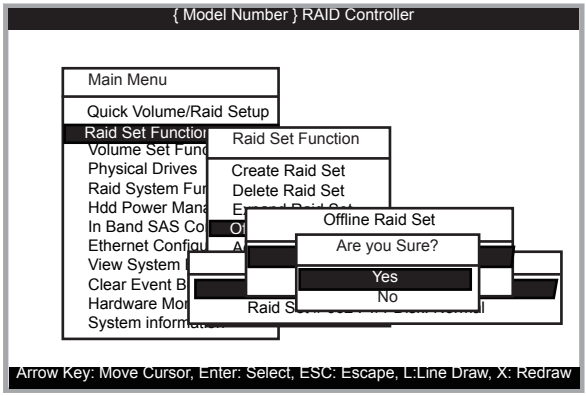
- **Migrating**

Migration occurs when a disk is added to a RAID set. Migrating state is displayed on the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs this RAID set.


{ Model Number } RAID Controller
Main Menu
Quick Volume/Raid Setup
Raid Set Function
The Raid Set Information
Raid Set Name : Raid Set # 000
Member Disks : 2
Raid State : Migrating
Raid Power State : Operating
Total Capacity : 1000.0GB
Free Capacity : 500.0GB
Min Member Disk Size : 500.0GB
Member Disk Channels : .E1S3.E1S4.
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

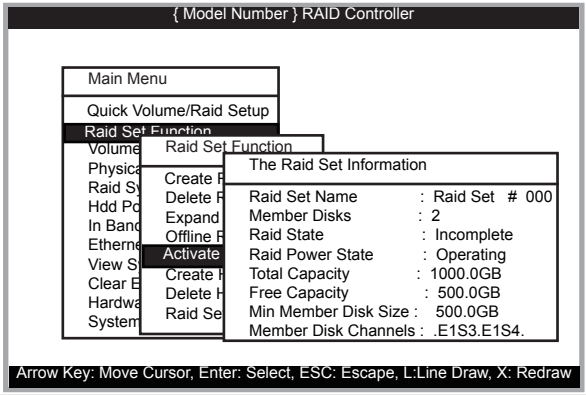
5.5.2.4 Offline Raid Set

This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state and spun down and fault LED will be in fast blinking mode.



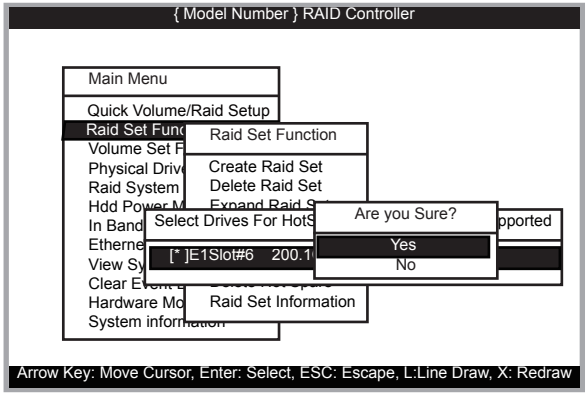
5.5.2.5 Activate Raid Set

The following screen is used to activate the RAID set after one of its disk drive was removed in the power off state.
When one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work while the RAID subsystem is powered on, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After user selects this function, the RAID state will change to "Degraded Mode" and start to work.


{ Model Number } RAID Controller
Main Menu
Quick Volume/Raid Setup
Raid Set Function
Expand
Offline
Activate
The Raid Set Information
Raid Set Name : Raid Set # 000
Member Disks : 2
Raid State : Incomplete
Raid Power State : Operating
Total Capacity : 1000.0GB
Free Capacity : 500.0GB
Min Member Disk Size : 500.0GB
Member Disk Channels : .E1S3.E1S4.
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

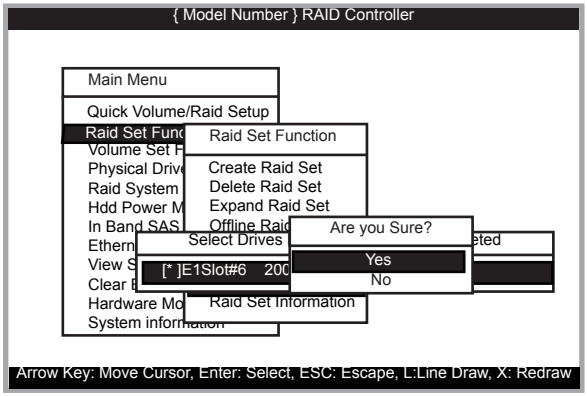
5.5.2.6 Create Hot Spare

When you choose the "Create Hot Spare" option in the "Raid Set Function", all unused physical devices connected to the current controller will result in the screen.
Select the target disk by clicking on the appropriate check box.
Press the **Enter** key to select a disk drive and press **Yes** in the "Create Hot Spare" to designate it as a hot spare.
The "Create Hot Spare" option gives you the ability to define a global hot spare.



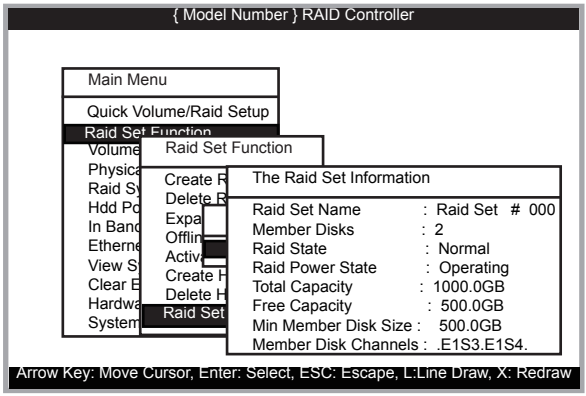
5.5.2.7 Delete Hot Spare

Select the target hot spare disk to delete by clicking on the appropriate check box.
Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the "Delete Hot Spare" screen to delete the hot spare.

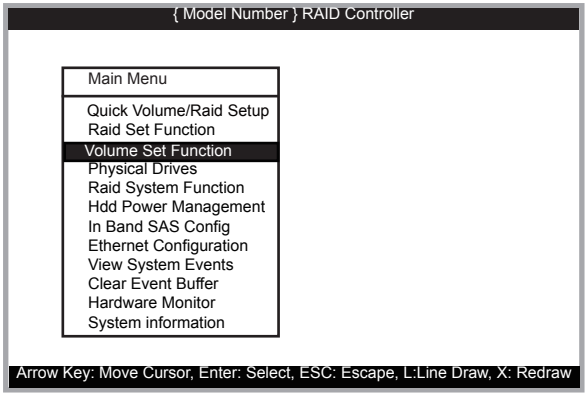


5.5.2.8 Raid Set Information

To display RAID set information, move the cursor bar to the desired RAID set number, then press the **Enter** key. The "Raid Set Information" will appear.
You can only view information for the RAID set in this screen.



5.5.3 Volume Set Function



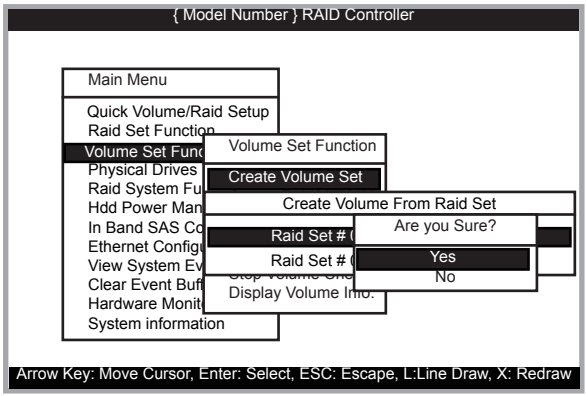
A volume set is seen by the host system as a single logical device; it is organized in a RAID level within the controller utilizing one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set can consume all of the capacity or a portion of the available disk capacity of a RAID set. Multiple volume sets can exist on a RAID

set. If multiple volume sets reside on a specified RAID set, all volume sets will reside on all physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set rather than one volume set using some of the available disks and another volume set using other disks.
The following is the volume set features for the RAID subsystem.
1. Volume sets of different RAID levels may coexist on the same RAID set.
2. Up to 128 volume sets can be created in a RAID set.
3. The maximum addressable size of a single volume set is not limited to 2TB, because the controller is capable of 64-bit LBA mode. However the operating system itself may not be capable of addressing more than 2TB.

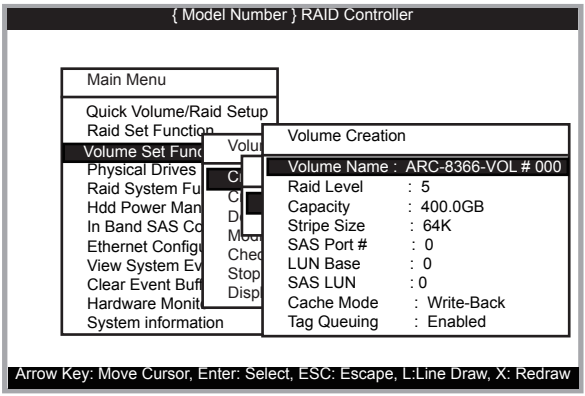
See Areca website ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/ Over2TB_050721.ZIP file for details.

5.5.3.1 Create Volume Set (0/1/10/3/5/6)

To create a volume set, following the steps:
1. Select the "Volume Set Function" from the main menu.
2. Choose the "Create Volume Set" from "Volume Set Functions" dialog box screen.
3. The "Create Volume From Raid Set" appears. This screen displays the existing arranged RAID sets. Select the RAID set number and press the **Enter** key. The "Volume Creation" dialog is displayed in the screen.



4. The new create volume set attribute allows user to select the Volume Name, Raid level, Capacity, Strip Size, SAS Port#/LUN Base/LUN, Cache Mode, Tagged Command Queuing .



5. After completed the modification of the volume set, press the **Esc** key to confirm it. An "Initialization Mode" screen appears.

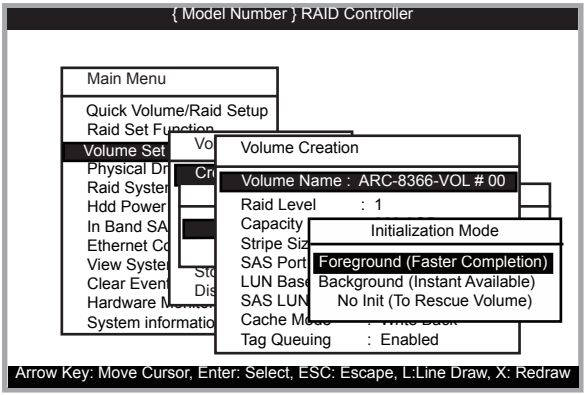
•Select "Foreground (Faster Completion)" for faster initialization of the selected volume set.

• Select "Background (Instant Available)" for normal initialization of the selected volume set.

• Select "No Init (To Rescue Volume)" for no initialization of the selected volume.

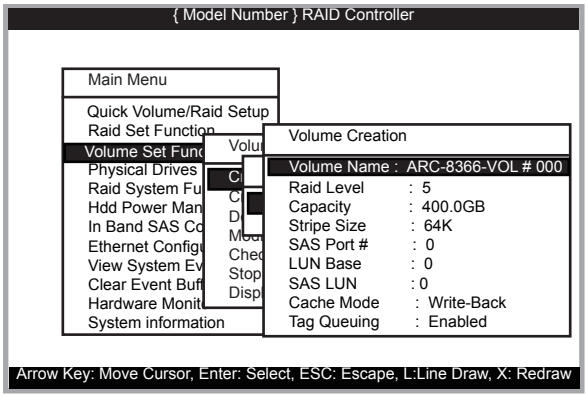
6. Repeat steps 3 to 5 to create additional volume sets.

7. The initialization percentage of volume set will be displayed at the button line.


{ Model Number } RAID Controller
Main Menu
Quick Volume/Raid Setup
Volume Creation
Volume Name : ARC-8366-VOL # 00
Raid Level : 1
Initialization Mode
Foreground (Faster Completion)
Background (Instant Available)
No Init (To Rescue Volume)
Tag Queuing : Enabled
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

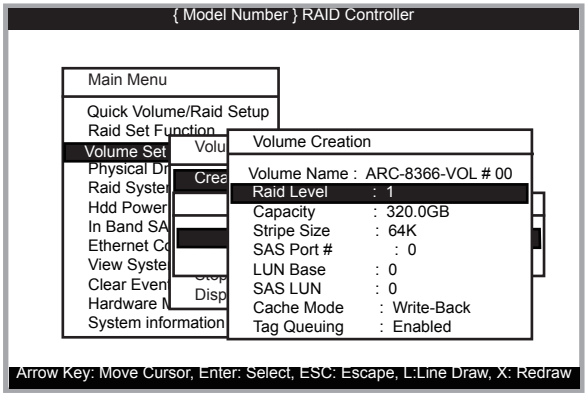
5.5.3.1.1 Volume Name

The default volume name will always appear as ARC-8366-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



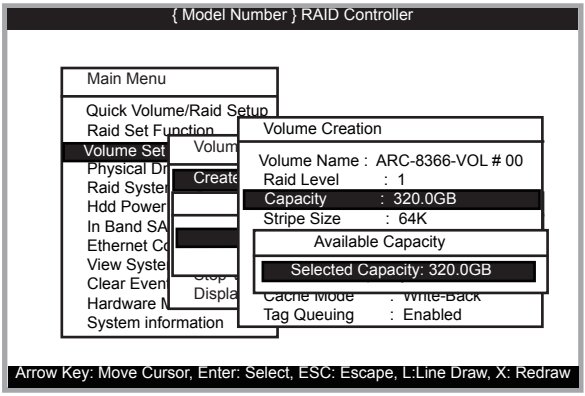
5.5.3.1.2 Raid Level

Set the RAID level for the volume set. Highlight "Raid Level" and press the **Enter** key. The available RAID levels for the current volume set are displayed. Select a RAID level and press the **Enter** key to confirm.

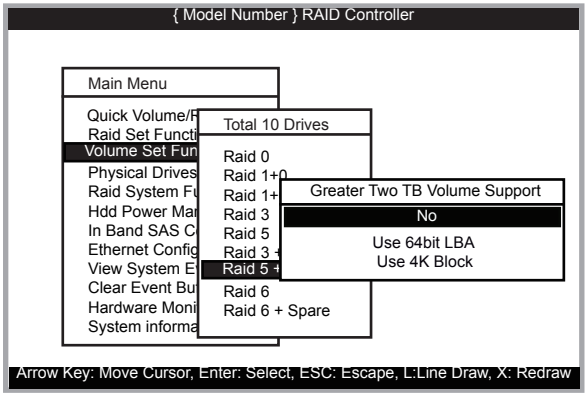


5.5.3.1.3 Capacity

The maximum available volume size is the default value for the first setting. Enter the appropriate volume size to fit your application. The capacity value can be increased or decreased by the **UP** and **DOWN** arrow keys. The capacity of each volume set must be less than or equal to the total capacity of the RAID set on which it resides.



If volume capacity will exceed 2TB, controller will show the "Greater Two TB Volume Support" sub-menu.



• **No**
It keeps the volume size with max. 2TB limitation.

• **64bit LBA**
This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity up to 512TB.

This option works on different OS which supports 16 bytes CDB. Such as:
Windows 2003 with SP1 or later
Linux kernel 2.6.x or later

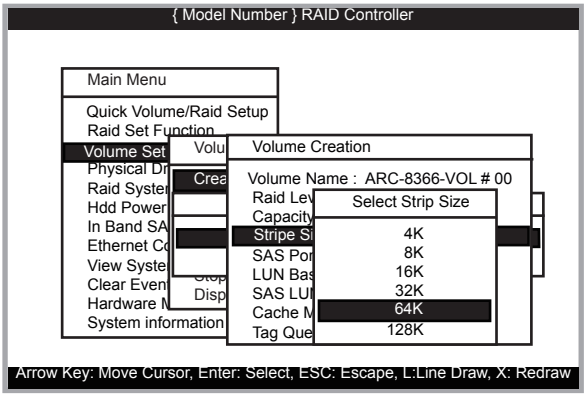
• **4K Block**
It changes the sector size from default 512 Bytes to 4k Bytes. the maximum volume capacity up to 16TB.

This option works under Windows platform only. And it can not be converted to "Dynamic Disk", because 4k sector size is not a standard format.

For more details, please download pdf file from **ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/Over2TB_050721.zip**

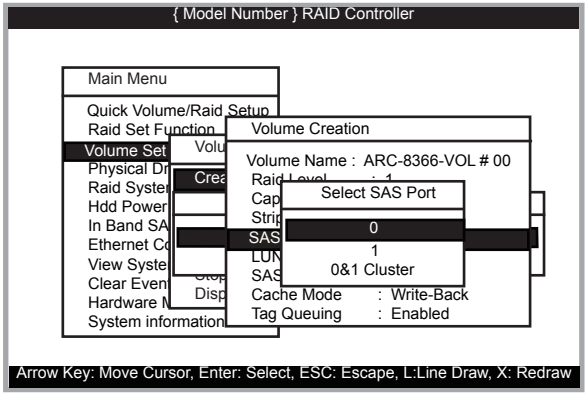
5.5.3.1.4 Stripe Size

This parameter sets the size of segment written to each disk in a RAID 0, 1, 10(1E), 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.

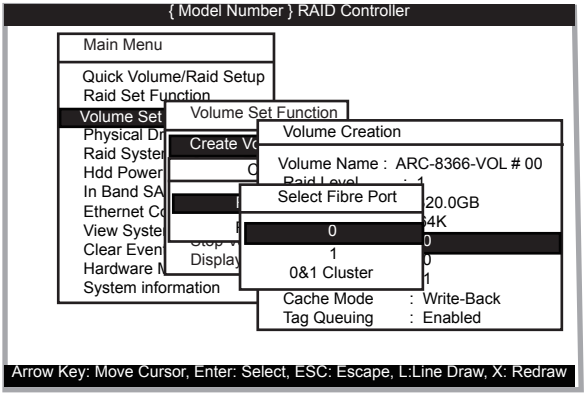


5.5.3.1.5 SAS Port #/ Fibre Host

Two 4-PHY links SAS ports can be applied to the RAID subsystem. Choose the SAS Port# option 0, 1 and 0&1 cluster.

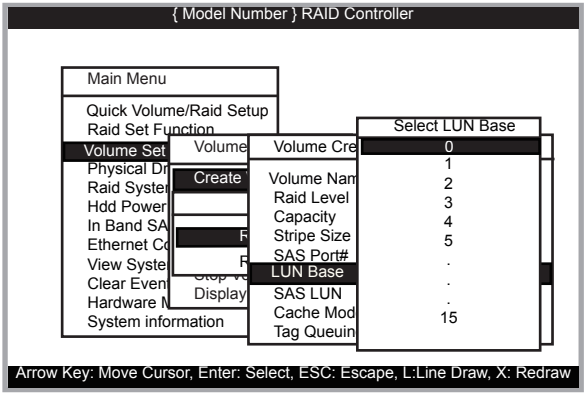


Four 8Gbps Fibre channel can be applied to the Fibre to SAS RAID subsystem. Choose the Fibre Host: "0", "1" or "0&1 Cluster" option. A **Select Fibre Channel** dialog box appears, select the channel number and press **Enter** key to confirm it.

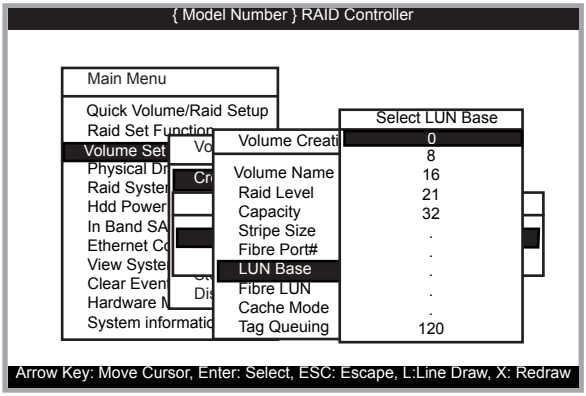


5.5.3.1.6 SAS LUN Base/Fibre LUN Base/iSCSI Target Node

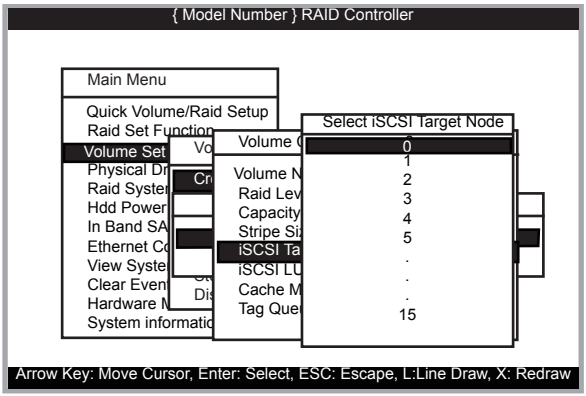
SAS LUN Base: Each SAS device attached to the SAS host adapter must be assigned a unique SAS ID number. A SAS port can connect up to 128 (16*8) volume sets. The RAID subsystem is as a large SAS device. We should assign an LUN base from a list of SAS LUNs.



Fibre LUN Base: Each fibre device attached to the Fibre card, as well as the card itself, must be assigned a unique fibre ID number. A Fibre channel controller can connect up to 128 (16*8) volume sets. The RAID subsystem is as a large Fibre device. We should assign an LUN base from a list of Fibre LUNs.

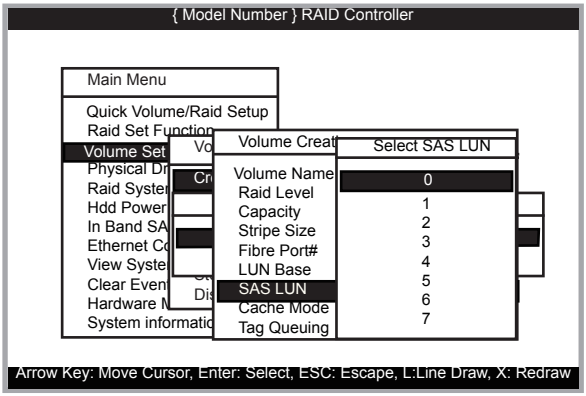


Target Node: A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/ SATA device. We should assign a Node from a list of Target Node. A iSCSI controller can connect up to 128 (16*8) volume sets.

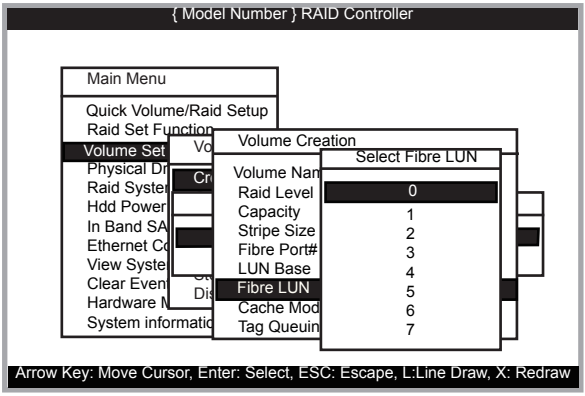


5.5.3.1.7 SAS LUN/Fibre LUN/iSCSI LUN

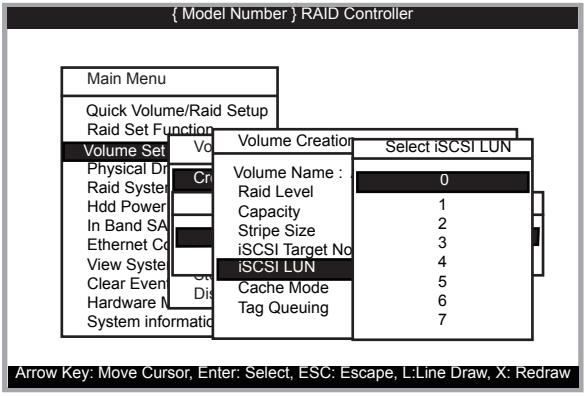
SAS LUN: Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.



Fibre LUN: Each Fibre LUN base can support up to 8 LUNs. Most Fibre Channel host adapter treats each LUN like a Fibre disk.

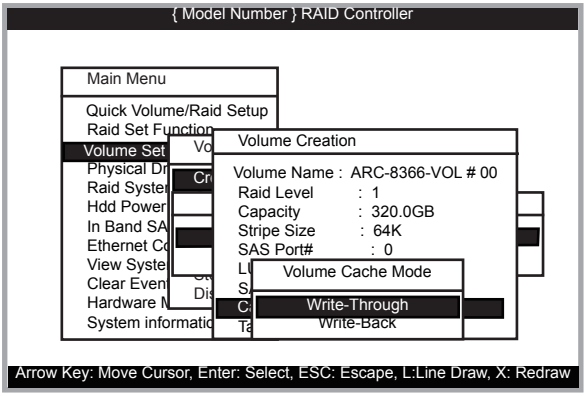


iSCSI LUN: Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.



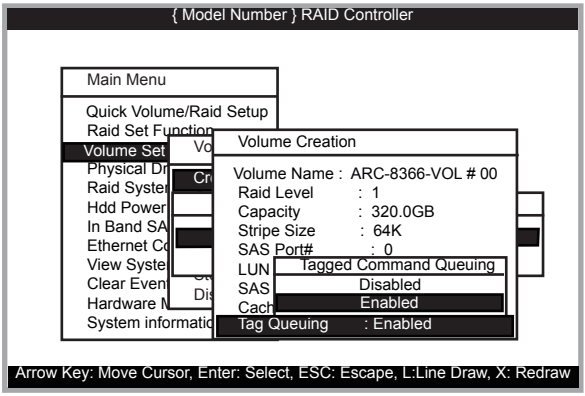
5.5.3.1.8 Cache Mode

User can set the cache mode to: "Write-Through" or "Write-Back".



5.5.3.1.9 Tag Queuing

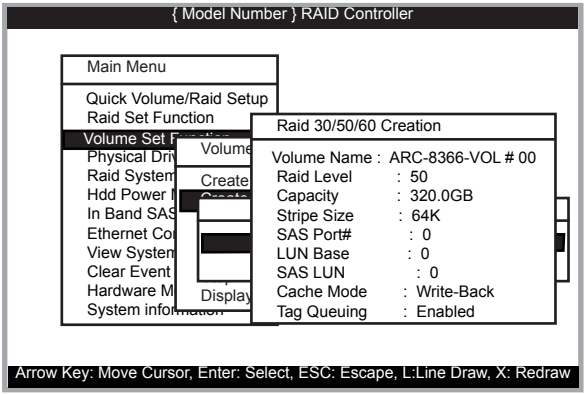
This option, when enabled, can enhance overall system performance under multi-tasking operating systems. The Command Tag Queuing (Drive Channel) function controls the SAS command tag queuing support for each drive channel. This function should normally remain enabled. Disabled this function only when using older drives that do not support Command Tag Queuing.



5.5.3.2 Create Raid30/50/60

To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same disk No per RAID set) that you want to create and then click on it.

The created new volume set attribute option allows users to select the Volume Name, Capacity, Raid Level, Stripe Size, SAS Port#/LUN Base/LUN, Cache Mode, and Tagged Command Queuing. The detailed description of those parameters can refer to section 5.5.3.1. User can modify the default values in this screen; the modification procedures are in section 5.5.3.4

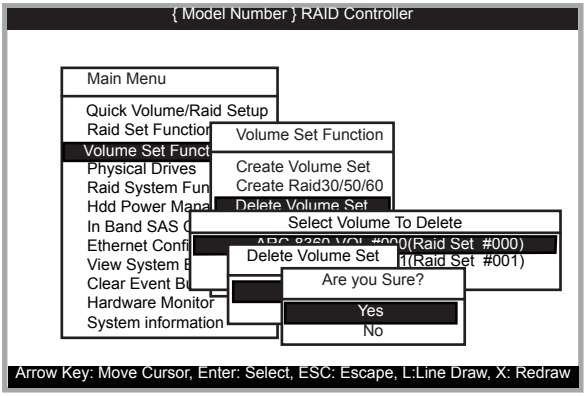


Note:

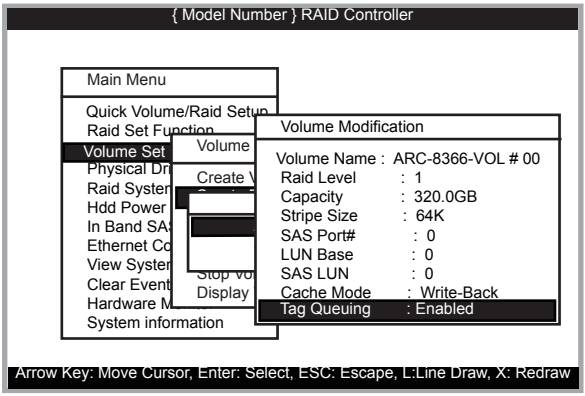
RAID level 30 50 and 60 can support up to eight RAID set.

5.5.3.3 Delete Volume Set

To delete volume set from a RAID set, move the cursor bar to the "Volume Set Functions" menu and select the "Delete Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all Raid Set # items. Move the cursor bar to a RAID set number, then press the **Enter** key to show all volume sets within that RAID set. Move the cursor to the volume set number that is to be deleted and press the **Enter** to delete it.



5.5.3.4 Modify Volume Set



Use this option to modify volume set configuration. To modify volume set values from RAID set system function, move the cursor bar to the "Modify Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all RAID set items. Move the cursor bar to a RAID set number item, then press the **Enter** key to show all volume set items. Select the volume set from the list to be changed, press the **Enter** key to modify it.

As shown, volume information can be modified at this screen. Choose this option to display the properties of the selected volume set. But user can only modify the last volume set capacity.

5.5.3.4.1 Volume Growth

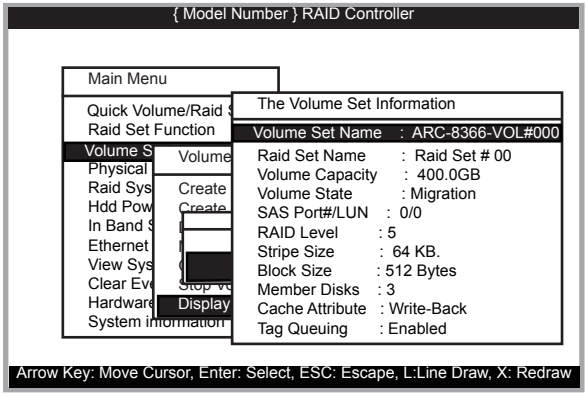
Use "Expand RAID Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the " Capacity" item and enter the capacity size. When finished the above action, press the **ESC** key and select the **Yes** option to complete the action. The last volume set starts to expand its capacity.

To expand an existing volume noticed:

- Only the last volume can expand capacity.
- When expanding volume capacity, you can't modify stripe size or modify RAID level simultaneously.
- You can expand volume capacity, but can't shrink volume capacity size.
- After volume expansion, the volume capacity can't be decreased.

For greater 2TB expansion:

- If your system installed in the volume, don't expand the volume capacity greater 2TB, currently OS can't support boot up from a greater than 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

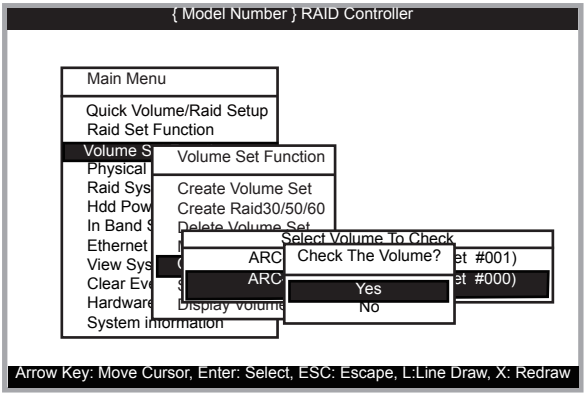


5.5.3.4.2 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, when a volume set strip size changes, or when a disk is added to a RAID set. Migration state is displayed in the volume state area of the "Volume Set Information" screen.

5.5.3.5 Check Volume Set

Use this option to verify the correctness of the redundant data in a volume set. For example, in a system with a dedicated parity disk drive, a volume set check entails computing the parity of the data disk drives and comparing those results to the contents of the dedicated parity disk drive. To check volume set, move the cursor bar to the "Check Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all RAID set number items. Move the cursor bar to an RAID set number item and then press the **Enter** key to show all volume set items. Select the volume set to be checked from the list and press **Enter** to select it. After completed the selection, the confirmation screen appears, press **Yes** to start the check.

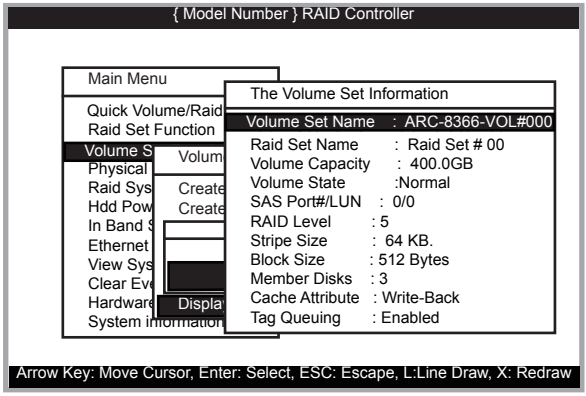


5.5.3.6 Stop Volume Set Check

Use this option to stop all of the "Check Volume Set" operations.

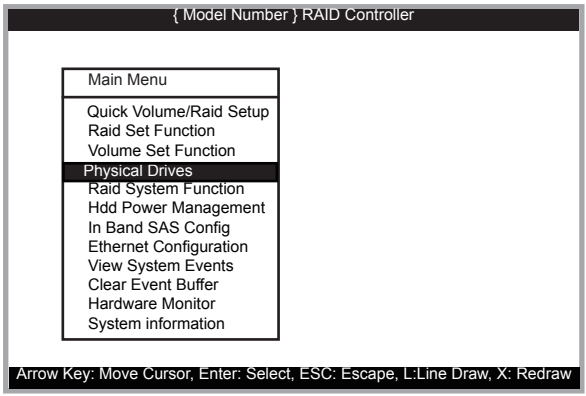
5.5.3.7 Display Volume Set Info.

To display volume set information, move the cursor bar to the desired volume set number and then press the **Enter** key. The "Volume Set Information" screen will be shown. You can only view the information of this volume set in this screen, but can not modify it.



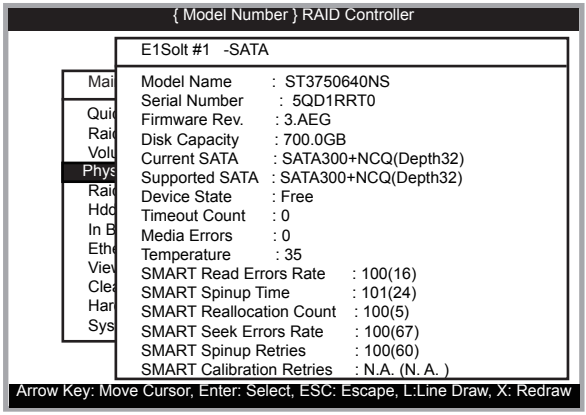
5.5.4 Physical Drives

Choose this option from the main menu to select a physical disk and perform the operations listed above. Move the cursor bar to an item, then press **Enter** key to select the desired function.



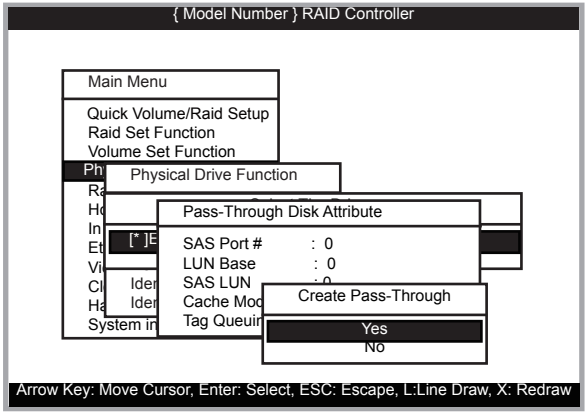
5.5.4.1 View Drive Information

When you choose this option, the physical disks connected to the RAID subsystem are listed. Move the cursor to the desired drive and press **Enter** key to view drive information.


{ Model Number } RAID Controller
E1Solt #1 -SATA
Model Name : ST3750640NS
Serial Number : 5QD1RRT0
Firmware Rev. : 3.AEG
Disk Capacity : 700.0GB
Current SATA : SATA300+NCQ(Depth32)
Supported SATA : SATA300+NCQ(Depth32)
Device State : Free
Timeout Count : 0
Media Errors : 0
Temperature : 35
SMART Read Errors Rate : 100(16)
SMART Spinup Time : 101(24)
SMART Reallocation Count : 100(5)
SMART Seek Errors Rate : 100(67)
SMART Spinup Retries : 100(60)
SMART Calibration Retries : N.A. (N. A.)
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

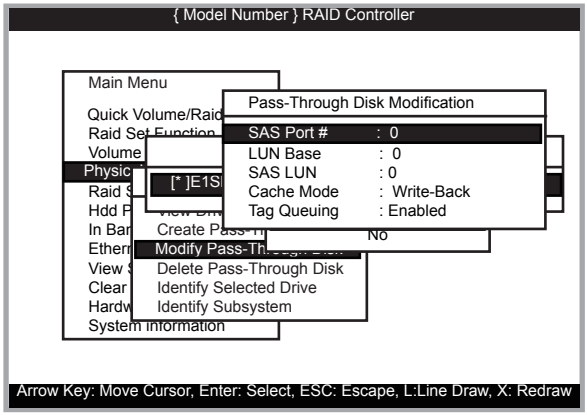
5.5.4.2 Create Pass-Through Disk

A pass-through disk is not controlled by the RAID subsystem's firmware and thus can not be a part of a volume set. The disk is available directly to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID subsystem's firmware. The SAS Port#/SAS LUN Base/SAS LUN, Cache Mode, and Tag Queuing must be specified to create a pass-through disk.



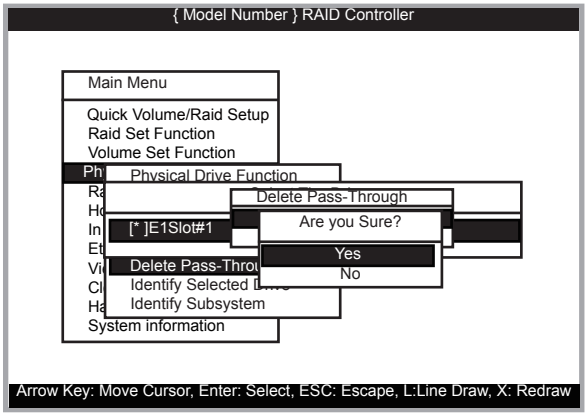
5.5.4.3 Modify Pass-Through Disk

Use this option to modify "Pass-Through Disk Attributes". To select and modify a pass-through disk from the pool of pass-through disks, move the "Modify Pass-Through Drive" option and then press the **Enter** key. The "Physical Drive Function" menu will show all pass-through drive number options. Move the cursor bar to the desired number and then press the **Enter** key to show all pass-through disk attributes. Select the parameter from the list to be changed and them press the **Enter** key to modify it.



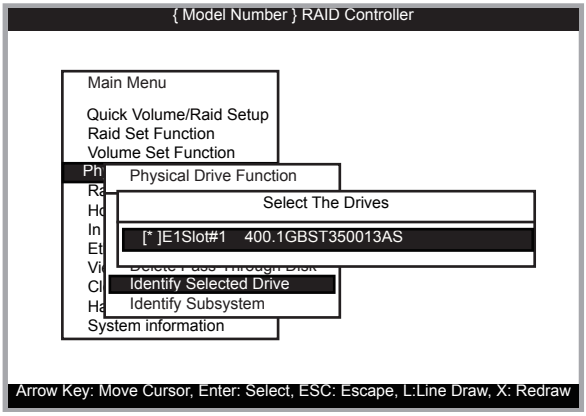
5.5.4.4 Delete Pass-Through Disk

To delete a pass-through drive from the pass-through drive pool, move the cursor bar to the "Delete Pass-Through Drive" item, then press the **Enter** key. The "Delete Pass-Through confirmation" screen will appear; select **Yes** to delete it.



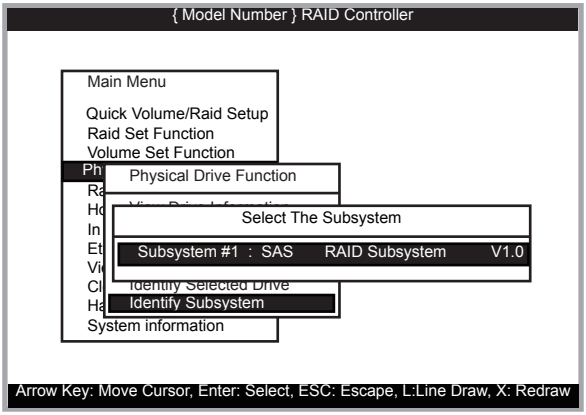
5.5.4.5 Identify Selected Drive

To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify Selected Device" is selected.

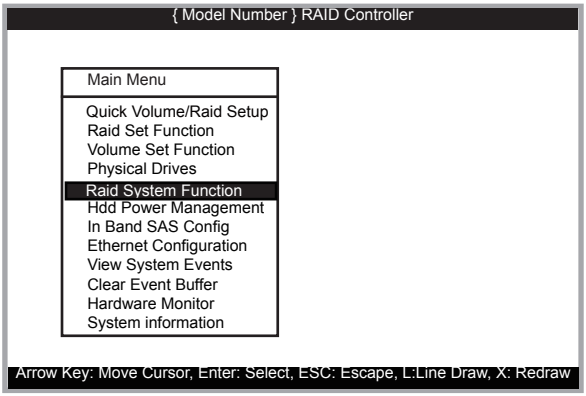


5.5.4.6 Identify Subsystem

To prevent removing the wrong subsystem, the selected Areca expander subsystem all disks fault LED Indicator will light for physically locating the selected subsystem when the "Identify Subsystem" is selected. This function will also light the subsystem LED indicator, if it is existed.


{ Model Number } RAID Controller
Main Menu
Quick Volume/Raid Setup
Raid Set Function
Volume Set Function
Physical Drive Function
Select The Subsystem
Subsystem #1 : SAS RAID Subsystem V1.0
Identify Subsystem
System information
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

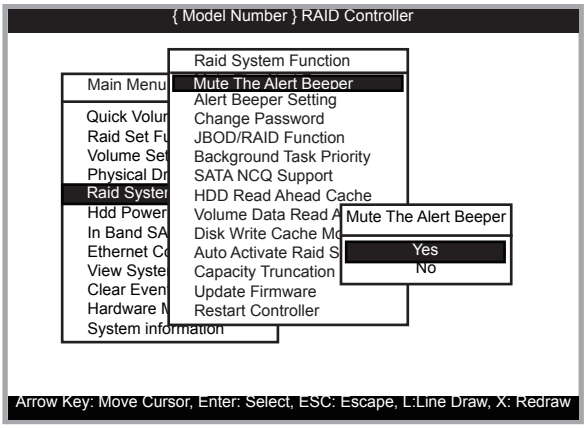
5.5.5 Raid System Function



To set the "Raid System Function", move the cursor bar to the main menu and select the "Raid System Function" item and then press **Enter** key. The "Raid System Function" menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.

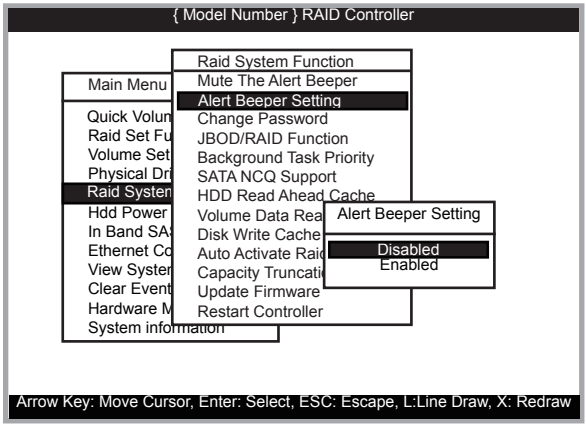
5.5.5.1 Mute The Alert Beeper

The "Mute The Alert Beeper" function item is used to control the RAID subsystem beeper. Select **Yes** and press the **Enter** key in the dialog box to turn the beeper off temporarily. The beeper will still activate on the next event.



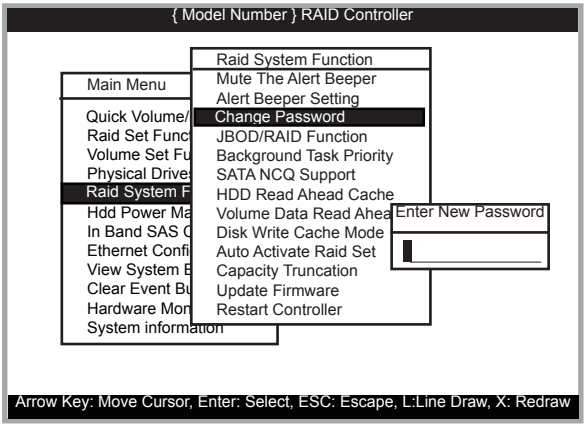
5.5.5.2 Alert Beeper Setting

The "Alert Beeper Setting" function item is used to "Disabled" or "Enabled" the RAID subsystem alarm tone generator. Select "Disabled" and press the **Enter** key in the dialog box to turn the beeper off.



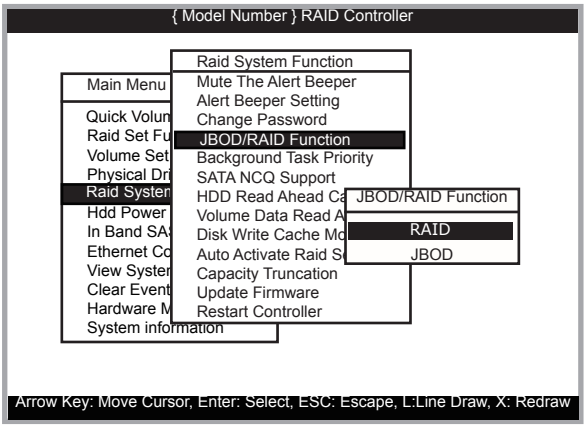
5.5.5.3 Change Password

The manufacture default password is set to 0000. The password option allows user to set or clear the password protection feature. Once the password has been set, the user can monitor and configure the controller only by providing the correct password. This feature is used to protect the internal RAID system from unauthorized access. The controller will check the password only when entering the main menu from the initial screen. The system will automatically go back to the initial screen if it does not receive any command in 5 minutes.
To set or change the password, move the cursor to "Raid System Function" screen, press the "Change Password" item. The "Enter New Password" screen will appear. Do not use spaces when you enter the password, If spaces are used, it will lock out the user. To disable the password, only press **Enter** key in both the "Enter New Password" and "Re-Enter New Password" column. The existing password will be cleared. No password checking will occur when entering the main menu.



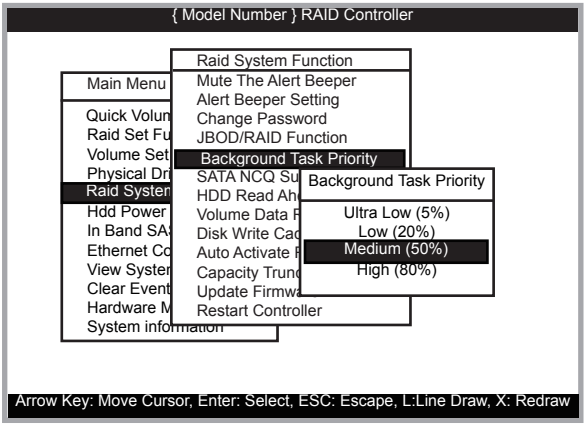
5.5.5.4 JBOD/RAID Function

JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.



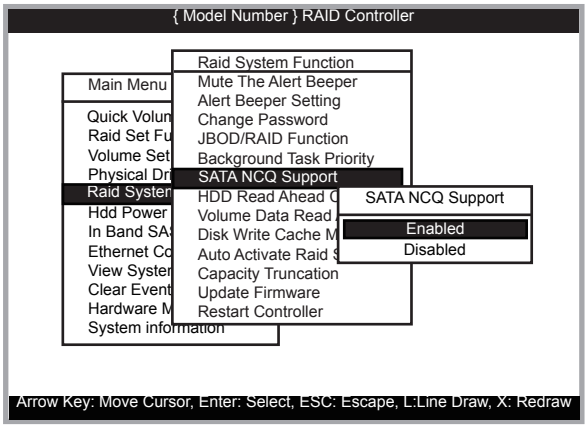
5.5.5.5 Background Task Priority

The "Background Task Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows the user to choose the rebuild priority (UltraLow, Low, Normal, High) to balance volume set access and rebuild tasks appropriately.



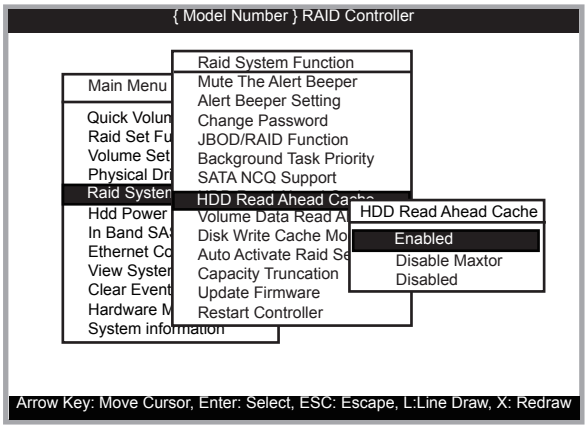
5.5.5.6 SATA NCQ Support

The controller supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".



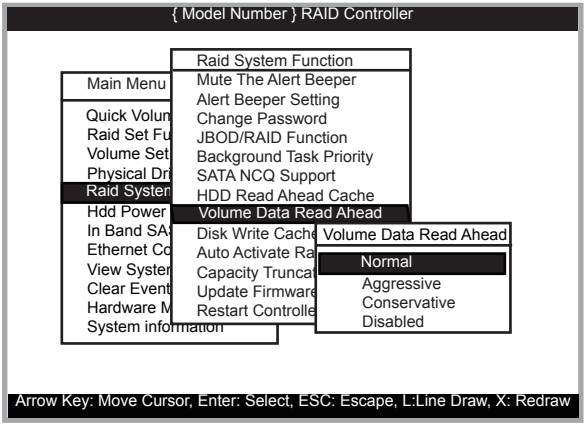
5.5.5.7 HDD Read Ahead Cache

Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.



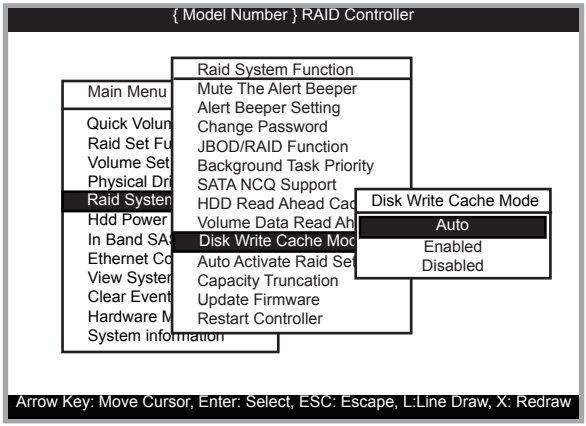
5.5.5.8 Volume Data Read Ahead

The "Data Read Ahead" parameter specifies the controller firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must know the application behavior. The default "Normal" option satisfies the performance requirements for a typical volume. The "Disabled" value implies no read ahead. The most efficient value for the controllers depends on your application. "Aggressive" read ahead is optimal for sequential access but it degrades random access.



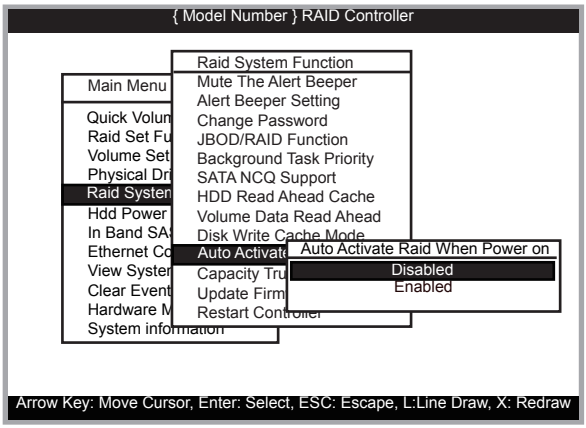
5.5.5.9 Disk Write Cache Mode

A user can set the “Disk Write Cache Mode”: Auto, Enabled, or Disabled.



5.5.5.10 Auto Activate Raid Set

When some of the disk drives are removed in power off state or boot up stage, the RAID set state will change to "Incomplete State". But if a user wants to automatically continue to work while the RAID subsystem is powered on, then user can set the "Auto Activate Raid Set" option to "Enabled". The RAID state will change to "Degraded Mode" while it powers on.



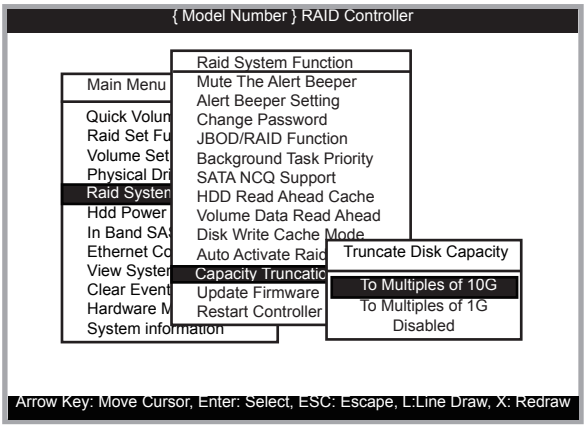
5.5.5.11 Capacity Truncation

The RAID subsystem uses drive truncation so that drives from different vendors are more likely to be usable as spares for one another. Drive truncation slightly decreases the usable capacity of a drive that is used in redundant units. The controller provides three truncation modes in the system configuration: Multiples Of 10G, Multiples Of 1G and Disabled.

Multiples Of 10G: If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. "Multiples Of 10G" truncates the number under tens. This makes the same capacity for both of these drives so that one could replace the other.

Multiples Of 1G: If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. "Multiples Of 1G" truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other. Example, one drive might be 123.5 GB, and the other 123.4 GB. "Multiples Of 1G" truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other.

Disabled: It does not truncate the capacity.



5.5.5.12 Update Firmware

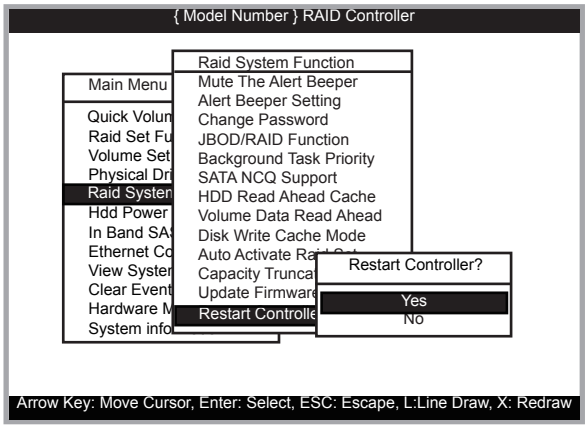
Please refer to the appendix A Upgrading Flash ROM Update Process.

Note:

1. User can only update the firmware through the VT-100 Terminal or web browser-based RAID manager through the controller's LAN port.

5.5.5.13 Restart Controller

Use the "Restart Controller" function to restart the RAID controller, move the cursor bar to the main menu "Raid System Function" item and then press the **Enter** key. The "Raid system Function" menu appears on the screen. Press **Enter** key to select "Restart Controller" item. The restart controller confirmation screen appears. Select **Yes** key to restart entire RAID controller.

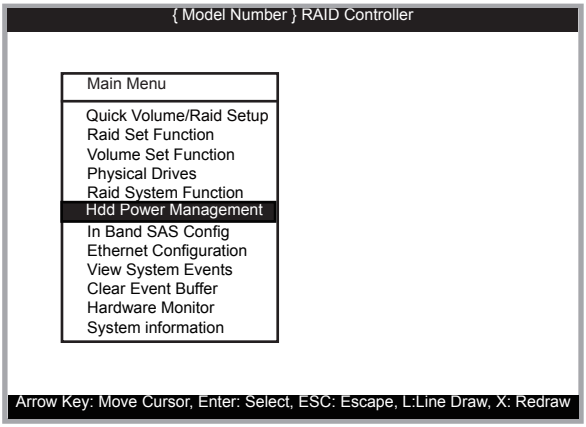


Note:

It can only work properly at Host and Drive without any activity.

5.5.6 Hdd Power Management

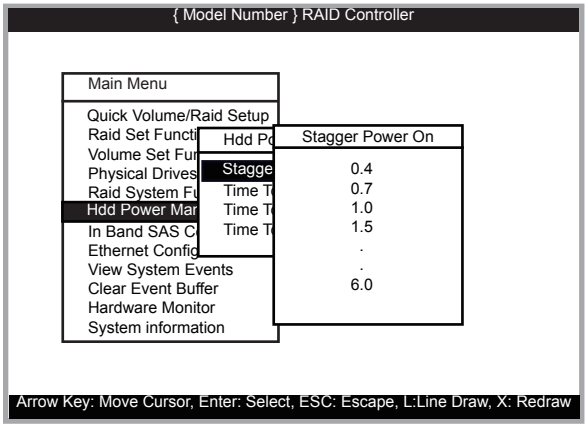
Areca has automated the ability to manage HDD power based on usage patterns. The "HDD Power Management" allows you to choose a "Stagger Power On Control", "Low Power Idle", "Low RPM" and completely "Spins Down Idle HDD". It is designed to reduce power consumption and heat generation on idle drives.



5.5.6.1 Stagger Power On Control

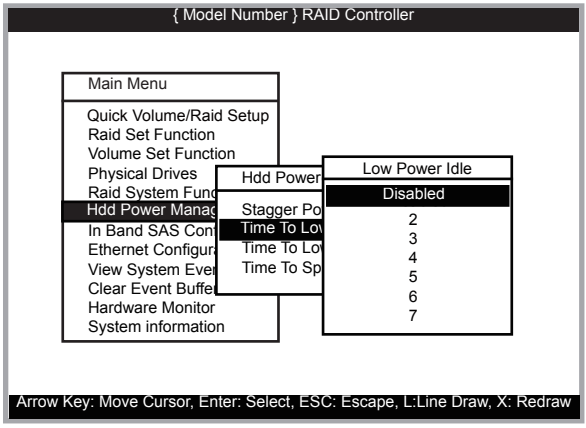
In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.



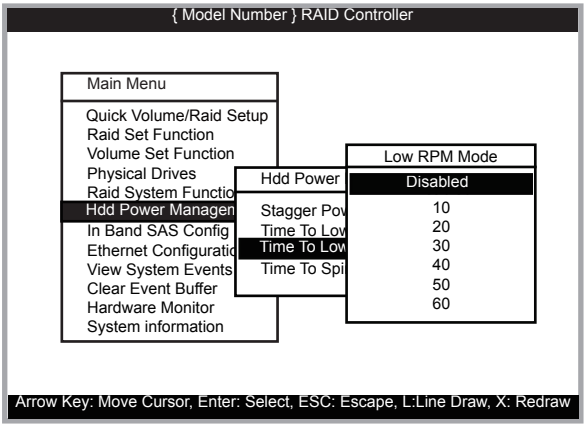
5.5.6.2 Time to Hdd Low Power Idle

This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.



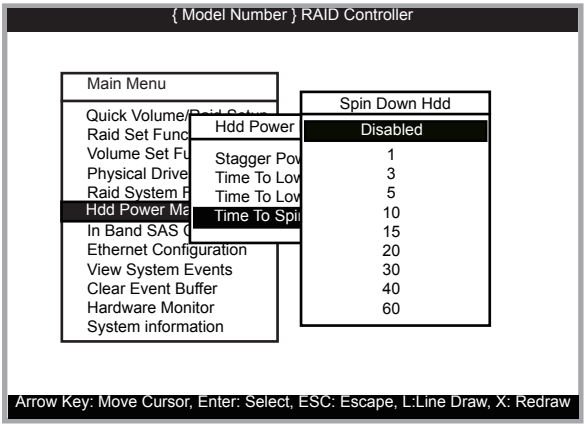
5.5.6.3 Time To Hdd Low RPM Mode

This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.



5.5.6.4 Time To Spin Down Idle HDD

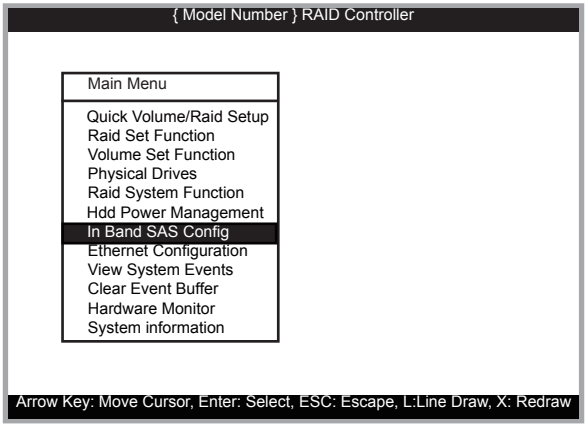
This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.



5.5.7 In Band SAS Config

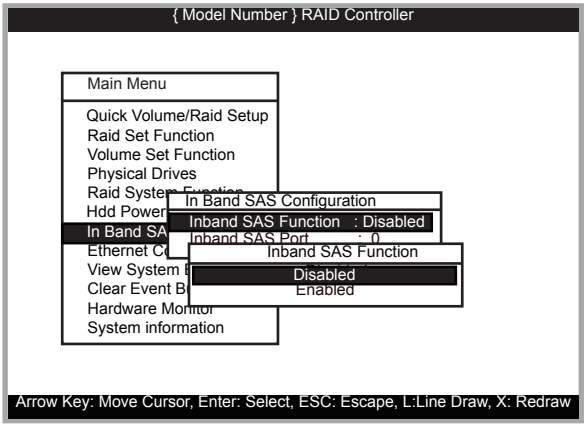
The RAID manager supports both in-band and out-of-band management to control the disk array subsystem. In-band management refers to management of the SAS disk array from a SAS host management transactions traverse the SAS bus. Out-of-band management refers to management of the disk array from a remote station connected to the controller either via a RS-232 or through a LAN port. In-band management is simpler than out-of-band management for it requires less hardware in its configuration.

Since the host adapter is already installed in the host system, no extra connection is necessary. Just load the necessary in-band driver for the controller and then combine the API with user's RAID manager from the local host to start management of the disk array system.



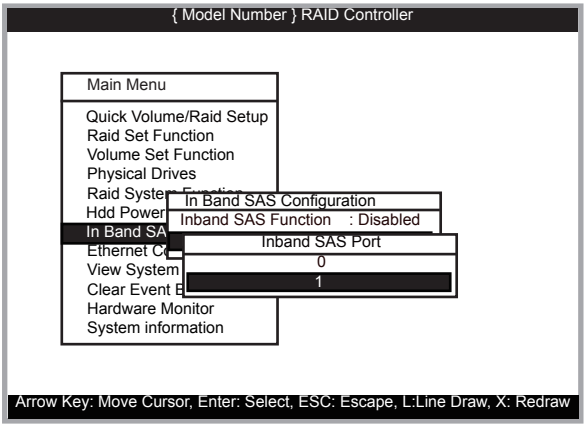
5.5.7.1 InBand SAS Function

The RAID subsystem reserves one LUN for In-band management transactions. This option is for user to release the LUN when In-band management is not enabled.



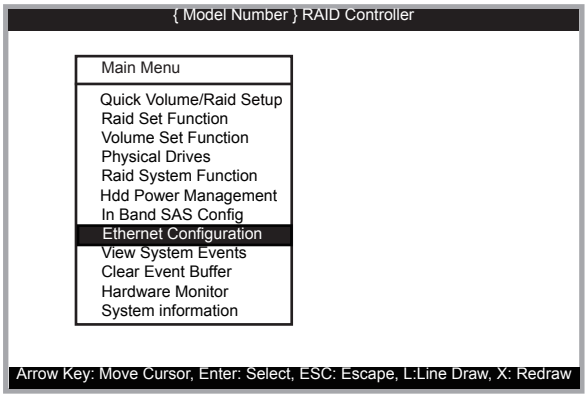
5.5.7.2 InBand SAS Port

Since the SAS RAID controller supports two SAS host ports, the In-band can through either SAS port 0 or port 1.



5.5.8 Ethernet Configuration

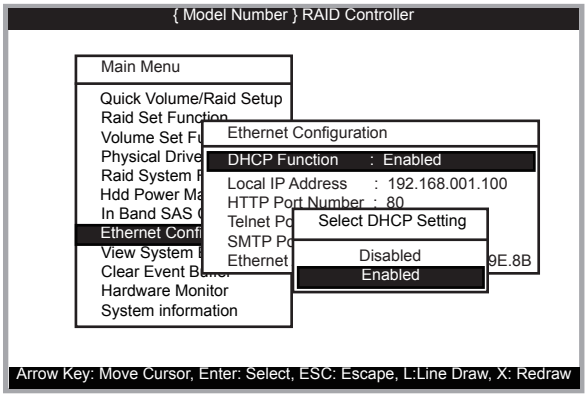
Use this feature to set the controller Ethernet port configuration. It is not necessary to create reserved disk space on any hard disk for the Ethernet port and HTTP service to function; these functions are built into the controller firmware.move the cursor bar to the main menu "Ethernet Configuration Function" item and then press the **Enter** key. The "Ethernet Configuration" menu appears on the screen. Move the cursor bar to an item, then press **Enter** key to select the desired function.



5.5.8.1 DHCP Function

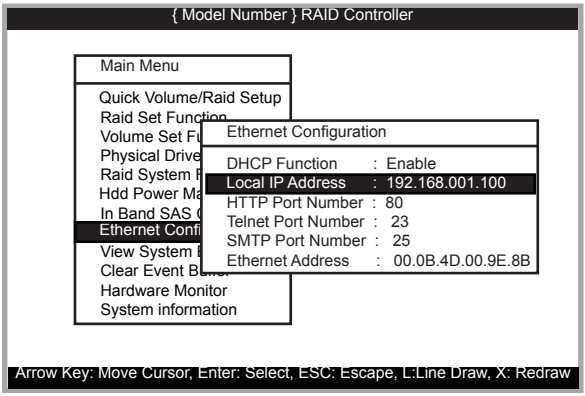
DHCP (Dynamic Host Configuration Protocol) allows network administrators centrally manage and automate the assignment of IP (Internet Protocol) addresses on a computer network. When using the TCP/IP protocol (Internet protocol), it is necessary for a computer to have a unique IP address in order to communicate to other computer systems. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of the controller, move the cursor bar to DHCP Function item, then press **Enter** key to show the DHCP setting. Select the "Disabled"

or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with other devices on the network.



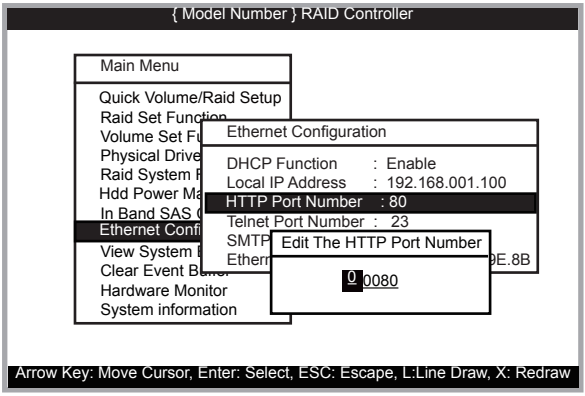
5.5.8.2 Local IP Address

If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address allocation scheme will reduce the time it takes to set-up client computers and eliminate the possibilities of administrative errors and duplicate addresses. To manually configure the IP address of the controller, move the cursor bar to Local IP address item, then press the **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the static IP address of the controller.



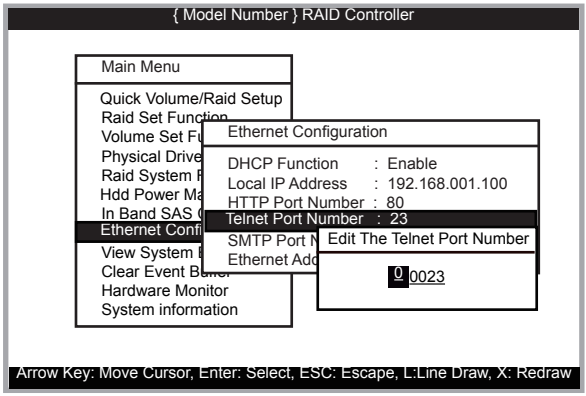
5.5.8.3 HTTP Port Number

To manually configure the "HTTP Port Number" of the controller, move the cursor bar to "HTTP Port Number" item, then press the **Enter** key to show the default address setting in the RAID subsystem. Then You can reassign the default "HTTP Port Number" of the controller.



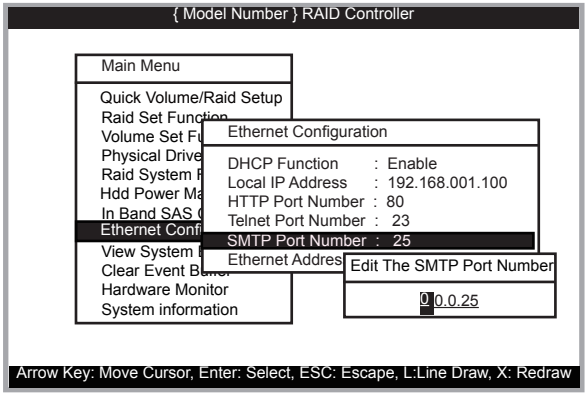
5.5.8.4 Telnet Port Number

To manually configure the "Telnet Port Number" of the controller, move the cursor bar to "Telnet Port Number" item, then press the **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the default "Telnet Port Number" of the controller.



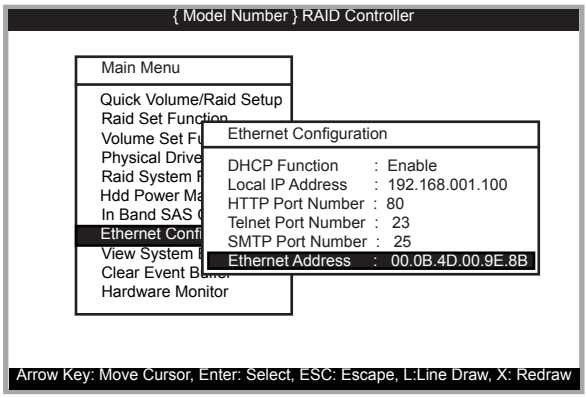
5.5.8.5 SMTP Port Number

To manually configure the "SMTP Port Number" of the controller, move the cursor bar to the main menu "Ethernet Configuration" function item and then press **Enter** key. The "Ethernet Configuration" menu appears on the screen. Move the cursor bar to "SMTP Port Number" item, then press **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the default "SMTP Port Number" of the controller.

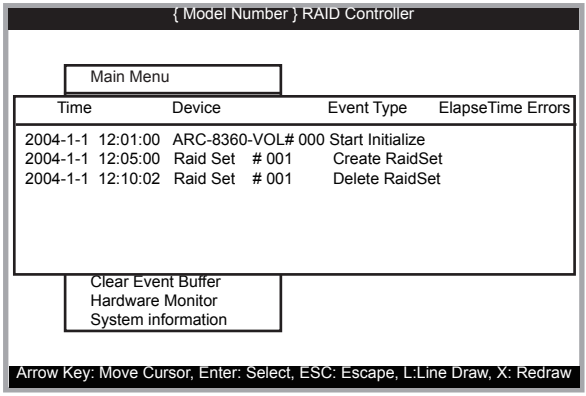


5.5.8.6 Ethernet Address

Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet address is used to uniquely identify a port in the Ethernet network.



5.5.9 View System Events


{ Model Number } RAID Controller
Main Menu
Time Device Event Type ElapseTime Errors
2004-1-1 12:01:00 ARC-8360-VOL# 000 Start Initialize
2004-1-1 12:05:00 Raid Set # 001 Create RaidSet
2004-1-1 12:10:02 Raid Set # 001 Delete RaidSet
Clear Event Buffer
Hardware Monitor
System information
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

To view the RAID subsystem's system events information, move the cursor bar to the main menu and select the "View System Events" link, then press the **Enter** key. The RAID subsystem's events screen appear.

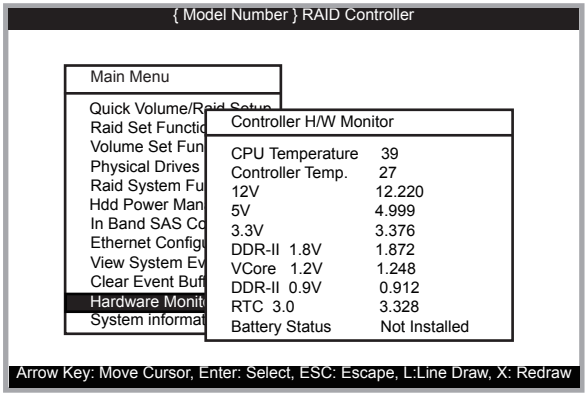
Choose this option to view the system events information: Timer, Device, Event type, Elapsed Time, and Errors. The RAID system does not have a build-in real time clock. The time information is the relative time from the RAID subsystem powered on.

5.5.10 Clear Events Buffer

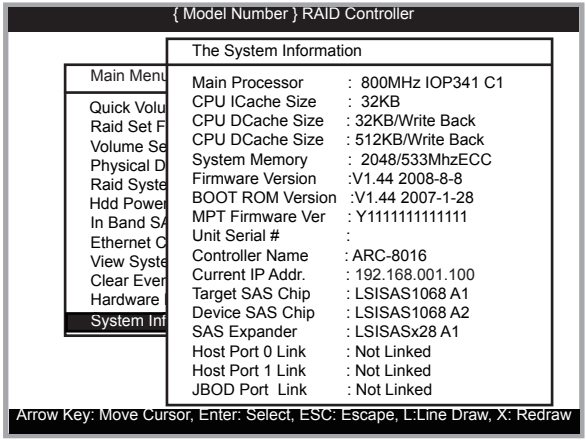
Use this feature to clear the entire events buffer.

5.5.11 Hardware Monitor Information

To view the RAID subsystem's hardware monitor information, move the cursor bar to the main menu and click the "Hardware Monitor" link. The "Controller H/W Monitor" screen appears. The "Controller H/W Monitor" provides the CPU temperature, controller temperature, voltage and battery status of the RAID subsystem.



5.5.12 System Information


{ Model Number } RAID Controller
Main Menu
The System Information
Main Processor : 800MHz IOP341 C1
CPU ICache Size : 32KB
CPU DCache Size : 32KB/Write Back
CPU DCache Size : 512KB/Write Back
System Memory : 2048/533MhzECC
Firmware Version :V1.44 2008-8-8
BOOT ROM Version :V1.44 2007-1-28
MPT Firmware Ver : Y1111111111111
Unit Serial # :
Controller Name : ARC-8016
Current IP Addr. : 192.168.001.100
Target SAS Chip : LSISAS1068 A1
Device SAS Chip : LSISAS1068 A2
SAS Expander : LSISASx28 A1
Host Port 0 Link : Not Linked
Host Port 1 Link : Not Linked
JBOD Port Link : Not Linked
Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

Choose this option to display the controller's hardware firmware information. The controller provides two four-link SFF-8088 connector for the host and one four-link connector SFF-8088 for JBOD. It may have problem between the host/JBOD and controller. The "Host Port# Link" provides current working port link status. The option for port link is defined below.
Not Linked → Fail or no link to host/JBOD
1x600 → Single-link for use
2x600 → Two-link for use
4x600 → Four-link for use

6. Web Browser-based Configuration

The RAID subsystem web browser-based configuration utility is firmware-based and uses to configure RAID sets and volume sets. Use this utility to:

- Create RAID set,
- Expand RAID set,
- Define volume set,
- Add physical drive,
- Modify volume set,
- Modify RAID level/stripe size,
- Define pass-through disk drives,
- Modify system function,
- Update firmware and,
- Designate drives as hot spares.

If you need to boot the operating system from a RAID subsystem, you must first create a RAID volume by using LCD panel, RS232 or LAN port.

6.1 Firmware-embedded TCP/IP & web browser-based RAID manager (using the controller's 10/100/1000 LAN port)

To ensure proper communications between the RAID subsystem and web browser-based RAID management, Please connect the RAID system LAN port to any LAN switch port.

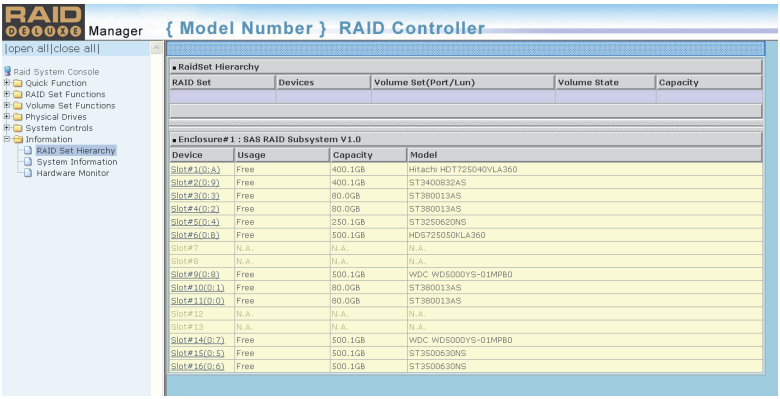
The RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100/1000 RJ45 LAN port.

To configure RAID subsystem on a local or remote machine, you need to know its IP Address. The IP address will default show in the LCD screen. Launch your firmware-embedded TCP/IP & Web Browser-based RAID manager by entering http://[IP Address] in the web browser.

You must be logged in as administrator with local admin rights on the remote machine to remotely configure it. The RAID subsystem default User Name is "admin" and the Password is "0000".

6.2 Web Browser Start-up Screen

The web browser start-up screen will display the current configuration of your RAID subsystem. It displays the Raid Set List, Volume Set List and Physical Disk List. The RAID set information, volume set information and drive information can also be viewed by clicking on the "RaidSet Hierarchy" screen. The current configuration can also be viewed by clicking on "RaidSet Hierarchy" in the menu.



To display RAID set information, move the mouse cursor to the desired RAID set number, then click it. The RAID set information will show in the screen.

To display volume set information, move the mouse cursor to the desired volume set number, then click it. The volume set information will show in the screen.

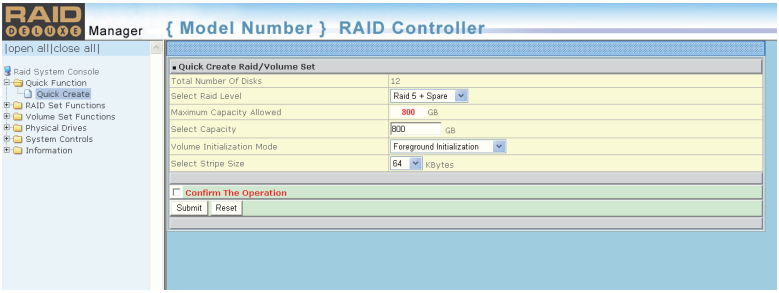
To display drive information, move the mouse cursor to the desired physical drive number, then click it. The drive information will show in the screen.

6.3 Main Menu

The main menu shows all available functions, accessible by clicking on the appropriate link.

Individual Category	Description
Quick Function	Create a default configuration, which is based on the number of physical disks installed; it can modify the volume set Capacity, Raid Level, and Stripe Size.
Raid Set Functions	Create a customized RAID set.
Volume Set Functions	Create customized volume sets and modify the existed volume sets parameter.
Physical Drives	Create pass through disks and modify the existing pass through drives parameters. Also provides the function to identify disk drives (blinking fault LED).
System Controls	Setting the RAID system configuration.
Information	Viewing the controller information. The Raid Set Hierarchy can be viewed through the "Raid Set Hierarchy" item.

6.4 Quick Function



The number of physical drives in the RAID subsystem determines the RAID levels that can be implemented with the RAID set. You can create a RAID set associated with exactly one volume set. The user can change the Raid Level, Capacity, Initialization Mode and Stripe Size. A hot spare option is also created, depending on the exist configuration. Click the "Confirm The Operation" check box and click on the "Submit" button in the "Quick Create" screen, the RAID set and volume set will start to initialize.

Note:

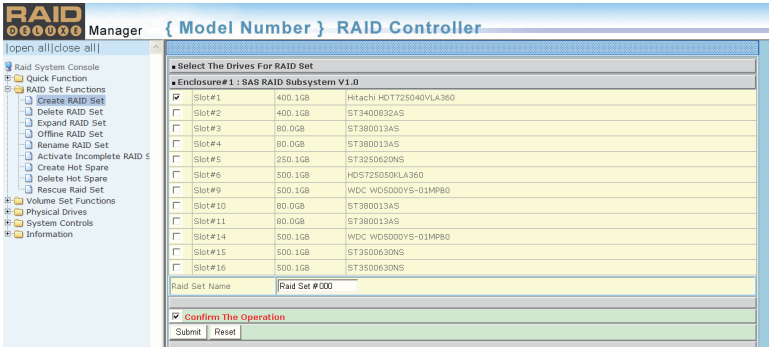
In "Quick Create", your volume set is automatically configured based on the number of disks in your system. Use the "Raid Set Functions" and "Volume Set Functions" if you prefer to customize your volume set, or RAID 30/50/60 volume set.

6.5 Raid Set Functions

Use the "Raid Set Function" and "Volume Set Function" if you prefer to customize your volume set. Manual configuration can provide full control of the RAID set settings, but it will take longer to complete than the "Quick Volume/Raid Setup" configuration. Select the "Raid Set Function" to manually configure the RAID set for the first time or delete and reconfigure existing RAID sets. (A RAID set is a group of disks containing one or more volume sets.)

6.5.1 Create a New Raid Set

To create a RAID set, click on the "Create Raid Set" link. A "Select The Drive For RAID Set" screen is displayed showing the drive(s) connected to the current controller and subsystems. Click on the selected physical drives within the current RAID set. Enter 1 to 15 alphanumeric characters to define a unique identifier for a RAID set. The default RAID set name will always appear as "Raid Set #". Click the "Confirm The Operation" check box and click on the "Submit" button on the screen; the RAID set will start to initialize. If you have available disk member, you can repeat above procedures to define another RAID sets.

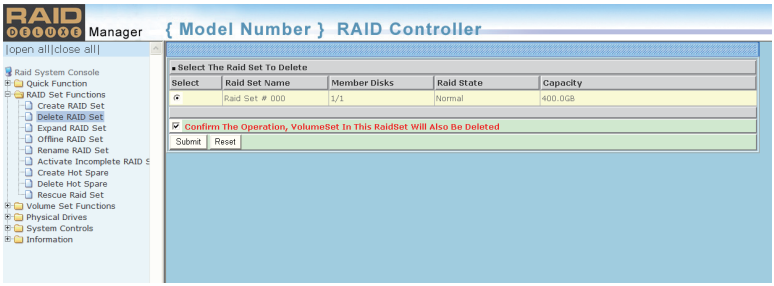


Note:

To create RAID 30/50/60 volume, you need create multiple RAID sets first with the same disk members on each RAID set. The max no. disk drives per volume set:
32 for RAID 0/1/10(1E)/3/5/6 and 128 for RAID 30/50/60.

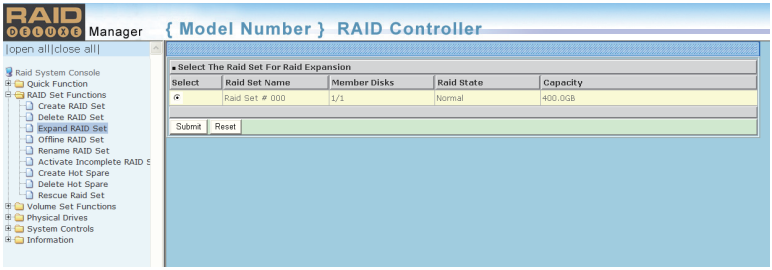
6.5.2 Delete Raid Set

To delete a RAID set, click on the "Deleted Raid Set" link. A "Select The RAID Set To Delete" screen is displayed showing all exist RAID sets in the current controller. Click the RAID set number which you want to delete in the select column on the delete screen. Then, click the "Confirm The Operation" check box and click on the "Submit" button in the screen to delete it. The volume sets included in the "Delete RAID Set" will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those RAID sets.



6.5.3 Expand Raid Set

Instead of deleting a RAID set and recreating it with additional disk drives, the "Expand Raid Set" function allows the users to add disk drives to the RAID set that have already been created.
To expand a RAID set:
Select the "Expand Raid Set" option. If there is an available disk, then the "Select SATA Drives For Raid Set Expansion" screen appears.
Select the target RAID set by clicking on the appropriate radio button. Select the target disk by clicking on the appropriate check box.



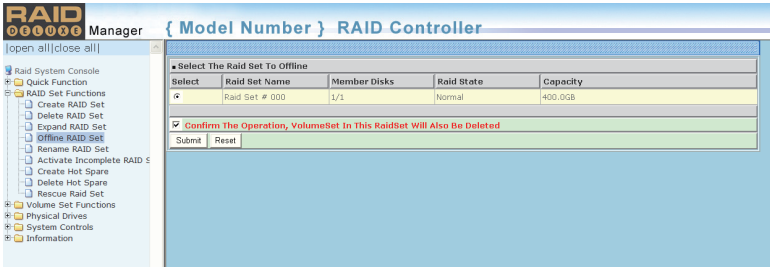
Press the **Yes** to start the expansion on the RAID set.
The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities may be required to expand operating system partitions.

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID 30/50/60 does not support the "Expand Raid set".

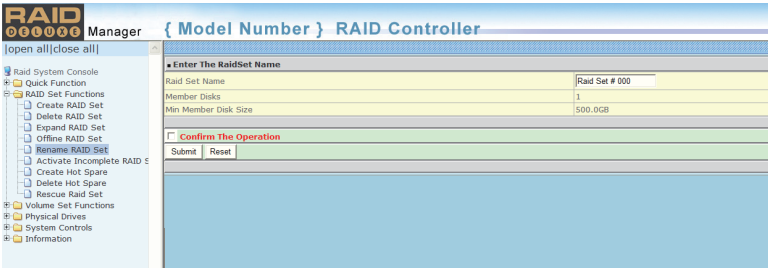
6.5.4 Offline Raid Set

This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state, spun down and fault LED in fast blinking mode. User can remove those Hdds and insert new Hdds on those empty slots without needing power down the controller.



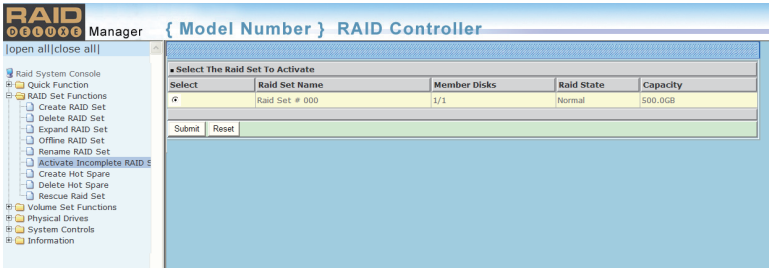
6.5.5 Rename Raid Set

The default RAID set name will always appear as "Raid Set #" when it is firstly created by the controller. The "Rename Raid Set" function is for customer to rename the default RAID set name.
To rename a RAID set from a group of RAID sets:
(1). Click on the " Rename Raid Set" link.
(2). Click the RAID set check box from the list that you wish to rename. Click the "Submit" button. The following screen appears. Use this option to rename the RAID set name.



6.5.6 Activate Incomplete Raid Set

If one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If the user wants to continue to operate the controller without power-off the RAID subsystem, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After the user completes this function, the Raid State will change to "Degraded Mode" and start to work.

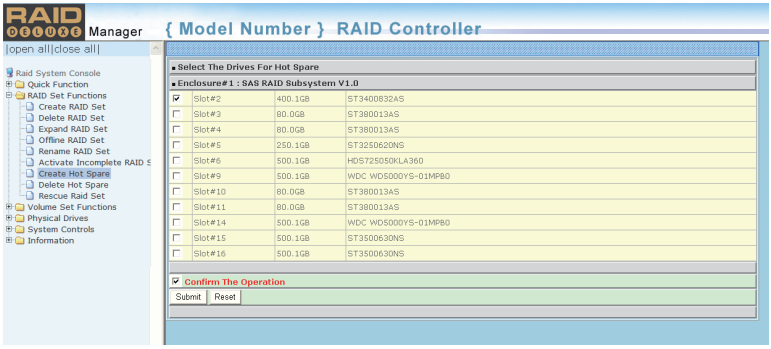


To activate the incomplete the RAID set, click on the "Activate Raid Set" link. A "Select The RAID Set To Activate" screen is displayed showing all RAID sets existing on the current controller. Click the RAID set number to activate in the select column.

Click on the "Submit" button on the screen to activate the RAID set that had a disk removed (or failed) in the power off state. The RAID subsystem will continue to work in degraded mode.

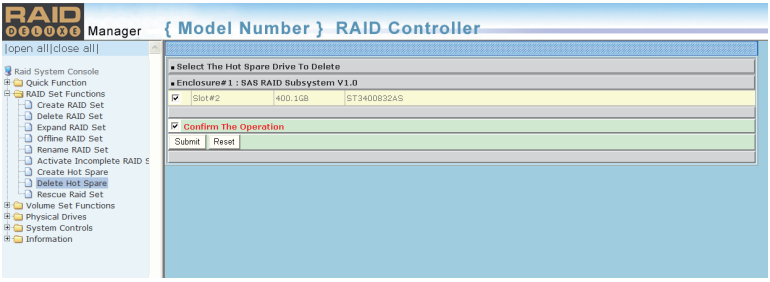
6.5.7 Create Hot Spare

When you choose the "Create Hot Spare" option in the "Raid Set Function", all unused physical devices connected to the current controller appear. Select the target disk by clicking on the appropriate check box. Click the "Confirm The Operation" check box and click the "Submit" button in the screen to create the hot spares. The "Create Hot Spare" option gives you the ability to define a global hot spare.



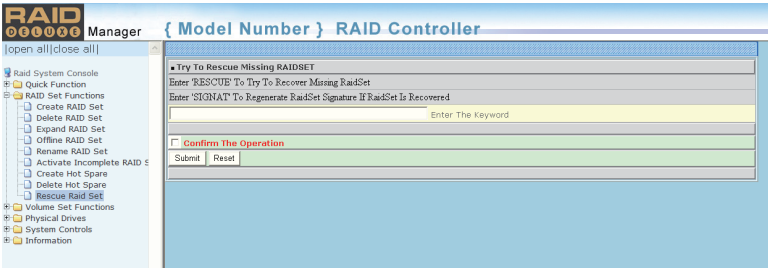
6.5.8 Delete Hot Spare

Select the target hot spare disk to delete by clicking on the appropriate check box. Click the "Confirm The Operation" check box and click the "Submit" button on the screen to delete the hot spares.



6.5.9 Rescue Raid Set

When the system is powered off in the RAID set update/creation period, the configuration possibly could disappear due to this abnormal condition. The "RESCUE" function can recover the missing RAID set information. The RAID subsystem uses the time as the RAID set signature. The RAID set may have different time after the RAID set is recovered. The "SIGANT" function can regenerate the signature for the RAID set. Please contact with manufacture's technical support before you use this configuration.



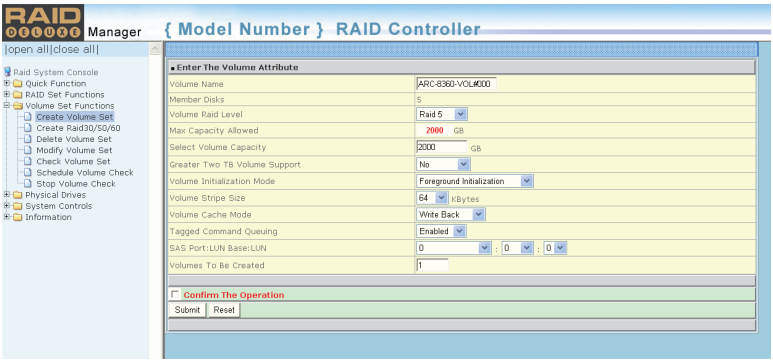
6.6 Volume Set Functions

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of the disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set. Additional volume sets created in a specified RAID set will reside on all the physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set.
The following is the volume set features for the RAID subsystem.
1. Volume sets of different RAID levels may coexist on the same RAID set.
2. Up to 128 volume sets can be created in a RAID set.
3. The maximum addressable size of a single volume set is not limited to 2TB, because the controller is capable of 64-bit LBA mode. However the operating system itself may not be capable of addressing more than 2TB.

See Areca website ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/ Over2TB_050721.ZIP file for details.

6.6.1 Create Volume Set (0/1/10/3/5/6)

To create volume set from RAID set system, move the cursor bar to the main menu and click on the "Create Volume Set" link. The "Select The Raid Set To Create On It" screen will show all RAID set number. Tick on a RAID set number that you want to create and then click on the "Submit" button.
The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Strip Size, Cache Mode, Tagged Command Queuing, SAS Port/LUN Base/LUN and Volumes To Be Created.



- **Volume Name**

The default volume name will always appear as "ARC-1680-VOL". You can rename the volume set providing it does not exceed the 15 characters limit.

- **Volume Raid Level**

Set the RAID level for the volume set. Highlight the desired RAID Level and press **Enter** key.
The available RAID levels for the current volume set are displayed. Select a RAID level and press **Enter** key to confirm.

- **Capacity**

The maximum volume size is the default initial setting. Enter the appropriate volume size to fit your application.

● Greater Two TB Volume Support
If volume capacity will exceed Two TB, controller will show the "Greater Two TB Volume Support" sub-menu. Greater Two TB Volume Support option: No and Yes.
For more details please download PDF file from **ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/Over2TB_050721.zip**

● Initialization Mode
This parameter is used to define "Background Initialization", "Foreground Initialization" or "No Init (To Rescue Volume)". When "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. When "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. There is no initialization happed when you select "No Init" option. "No Init" is for customer to rescue volume without losing data in the disk.

● Stripe Size
This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a smaller stripe size.

Note:

RAID level 3 can't modify the cache stripe size.

● Cache Mode
The RAID subsystem supports "Write-Through" and "Write-Back" cache.

● Tagged Command Queuing
The "Enabled" option is useful for enhancing overall system performance under multi-tasking operating systems. The Tag Command Queuing (Drive Channel) function controls the SAS

command tag queuing support for each drive channel. This function should normally remain "Enabled". "Disabled" this function only when using SAS drives that do not support Tag Command Queuing.

- **SAS Port/LUN Base/LUN**

SAS Port: Two 4-PHY links SAS ports can be applied to the RAID subsystem. The RAID subsystem supports Port 0,1 and 0&1 cluster option.

LUN base: Each SAS device attached to the SAS host adapter must be assigned a unique SAS ID number. A SAS port can connect up to 128 (16*8) volume sets. The RAID subsystem is as a large SAS device. We should assign a LUN base from a list of SAS LUNs.

SAS LUN: Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.

- **Fibre Port/LUN Base/LUN**

Fibre Port: Four 8Gbps Fibre channel can be applied to the internal RAID subsystem. Choose the Fibre Host#. A "Select Fibre Channel" dialog box appears, select the channel number and press **Enter** key to confirm it.

LUN Base: Each fibre device attached to the Fibre card, as well as the card itself, must be assigned a unique fibre ID number. A Fibre channel can connect up to 128(16*8) volume sets. The RAID subsystem is as a large Fibre device. We should assign a LUN base from a list of Fibre LUN Base.

Fibre LUN: Each Fibre LUN base can support up to 8 LUNs. Most Fibre Channel host adapter treats each LUN like a Fibre disk.

- **iSCSI Target Node/LUN**

Target Node: A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/ SATA device. We should assign a Node from a list of Target Node. A iSCSI channel can connect up to 128(16*8) volume sets.

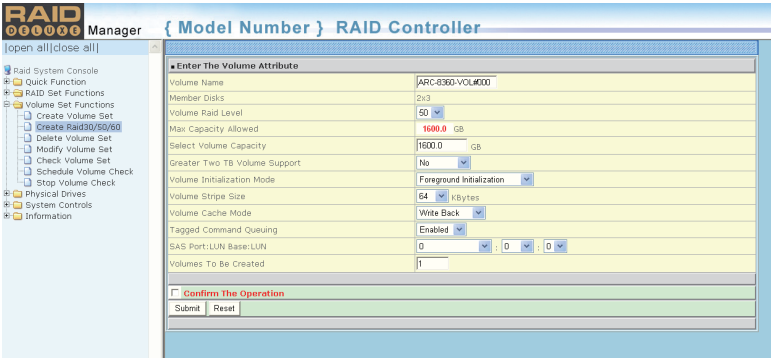
iSCSI LUN: Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.

- **Volume To Be Created**

The RAID subsystem can support up to 128 volume sets. This option is defined volume number using the same volume set attribute here.

6.6.2 Create Raid30/50/60 (Volume Set 30/50/60)

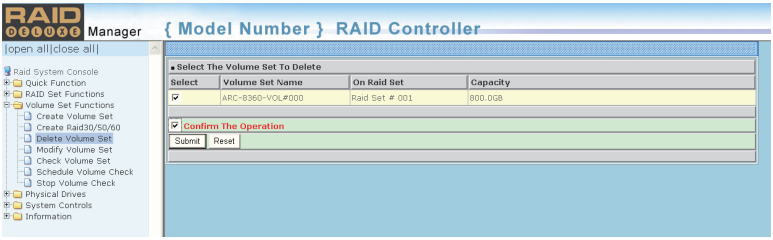
To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same disk No per RAID set) that you want to create and then click on the "Submit" button.
The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Stripe Size, Cache Mode, Tagged Command Queuing, SAS Port/LUN Base/LUN and Volumes To Be Created. Please refer to above section for details description of each item.



6.6.3 Delete Volume Set

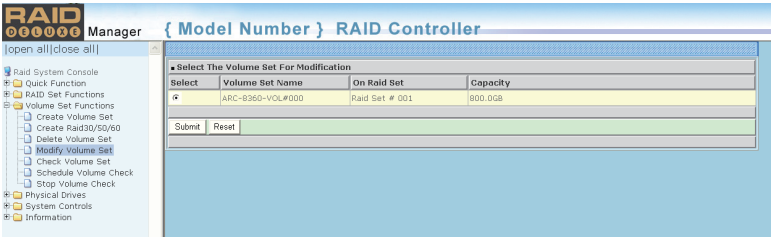
To delete a volume from RAID set, move the cursor bar to the main menu and click on the "Delete Volume Set" link. The "Select The Raid Set To Delete" screen will show all RAID set numbers. Click a RAID set number and the "Confirm The Operation" check

box and then click the "Submit" button to show all volume set items in the selected RAID set. Click a volume set number and the "Confirm The Operation" check box and then click the "Submit" button to delete the volume set.



6.6.4 Modify Volume Set

To modify a volume set from a RAID set:
(1). Click on the "Modify Volume Set" link.
(2). Click the volume set check box from the list that you wish to modify. Click the "Submit" button. The following screen appears. Use this option to modify the volume set configuration. To modify volume set attributes, move the cursor bar to the volume set attribute menu and click it. The "Enter The Volume Attribute" screen appears. Move the cursor to an attribute item and then click the attribute to modify the value. After you complete the modification, click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The user can only modify the last volume set capacity.



6.6.4.1 Volume Growth

Use "Expand RAID Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the " Capacity" item and enter the capacity size. When finished the above action,click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The last volume set starts to expand its capacity.

To expand an existing volume noticed:

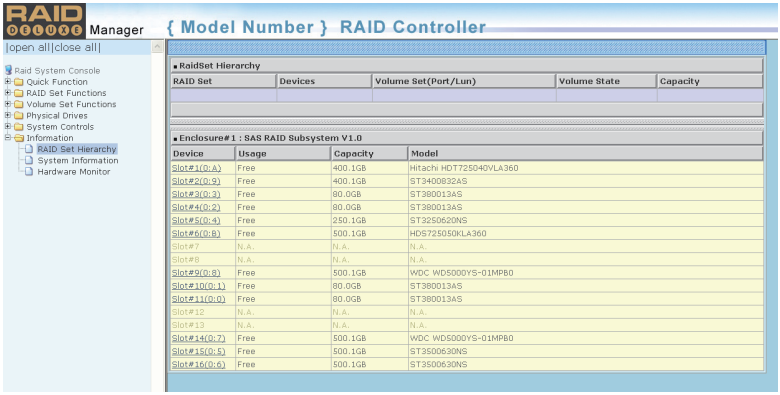
- Only the last volume can expand capacity.
- When expanding volume capacity, you can't modify stripe size or modify RAID level simultaneously.
- You can expand volume capacity, but can't shrink volume capacity size.
- After volume expansion, the volume capacity can't be decreased.

For greater 2TB expansion:

- If your system installed in the volume, don't expand the volume capacity greater than 2TB, currently OS can't support boot up from a greater than 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

6.6.4.2 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, when a volume set strip size changes, or when a disk is added to a RAID set. Migration state is displayed in the volume state area of the "Volume Set Information" screen.



Note:

1. If the volume is RAID level 30, 50, or 60, you can not change the volume to another RAID level. If the volume is RAID level 0, 1, 10(1E), 3, 5, or 6, you can not change the volume to RAID level 30, 50, or 60.
2. RAID level 30 50 and 60 can support up to eight sub-volumes, but it can not support expansion and migration.

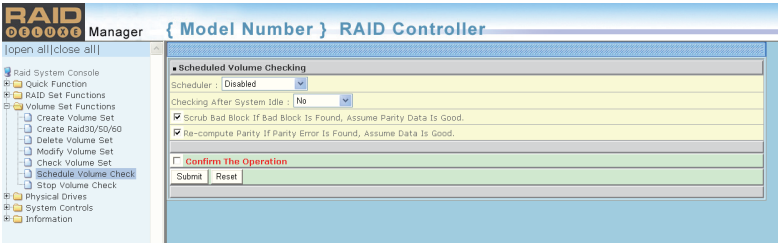
6.6.5 Check Volume Set

To check a volume set from a RAID set:
(1). Click on the "Check Volume Set" link.
(2). Click on the volume set from the list that you wish to check.

Tick on "Confirm The Operation" and click on the "Submit" button. Use this option to verify the correctness of the redundant data in a volume set. For example, in a system with dedicated parity, volume set check means computing the parity of the data disk drives and comparing the results to the contents of the dedicated parity disk drive. The checking percentage can also be viewed by clicking on "Raid Set Hierarchy" in the main menu.

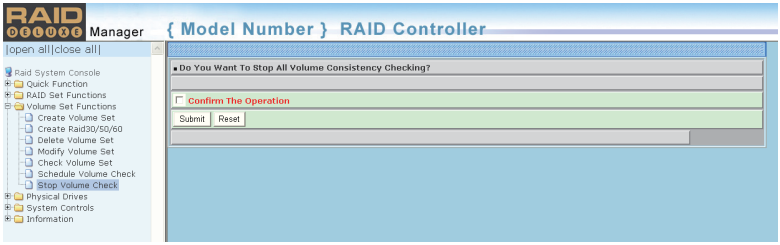
6.6.6 Schedule Volume Check

This function can setup a schedule so consistency checks are run automatically at regularly scheduled intervals. If there is a discrepancy found, it will log the error on the system event log. The controller will base on the user selection scrub bad block or re-compute parity to recovery the data. The recommended interval for checking consistency in RAID drives can set on "Scheduler" option. User can specify parameters to "Scheduler" to change the scheduled run time. The "Checking After System Idle" is defined the default time to start the automated consistency check scheduling.



6.6.7 Stop Volume Check

Use this option to stop the "Check Volume Set" function.

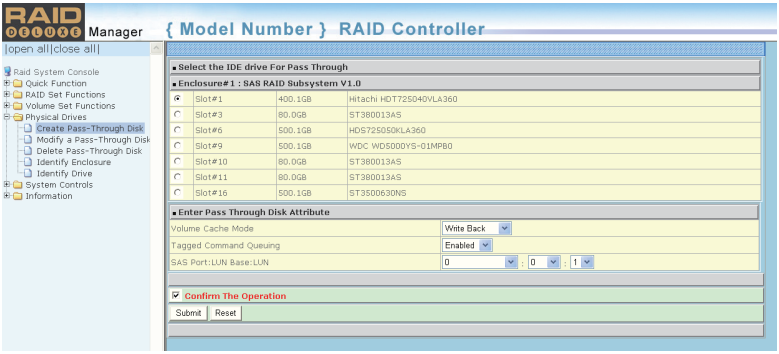


6.7 Physical Drive

Choose this option to select a physical disk from the main menu and then perform the operations listed below.

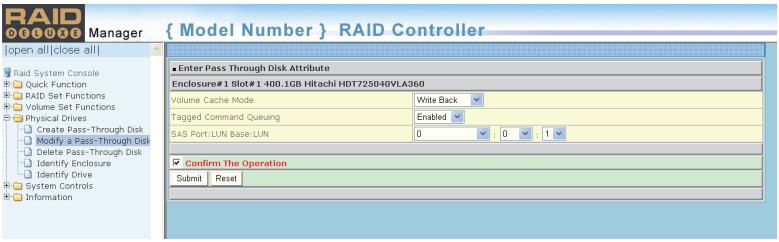
6.7.1 Create Pass-Through Disk

To create pass-through disk, move the mouse cursor to the main menu and click on the "Create Pass-Through" link. The relative setting function screen appears. A pass-through disk is not controlled by the RAID subsystem firmware, it can not be a part of a volume set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID firmware. The user can also select the Cache Mode, Tagged Command Queuing, SAS Port/LUN Base/LUN for this pass-through disk.



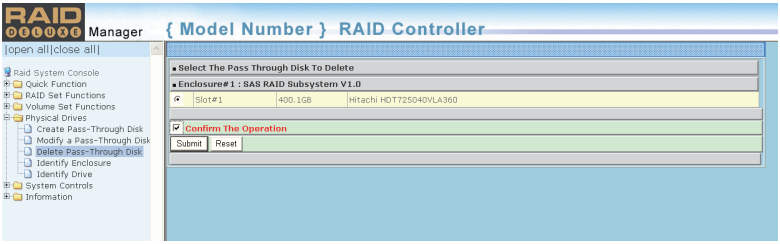
6.7.2 Modify a Pass-Through Disk

Use this option to modify the pass-through disk attribute. The user can modify the Cache Mode, Tagged Command Queuing, and SAS Port/LUN Base/LUN on an existing pass-through disk. To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the "Modify a Pass-Through" link. The "Select The Pass Through Disk For Modification" screen appears. Mark the check box for the pass-through disk from the pass-through drive pool and click on the "Submit" button to select the drive. When the "Enter Pass-Through Disk Attribute" screen appears, modify the drive attribute values, as you want. After you complete the selection, mark the check box for "Confirm The Operation" and click on the "Submit" button to complete the selection action.



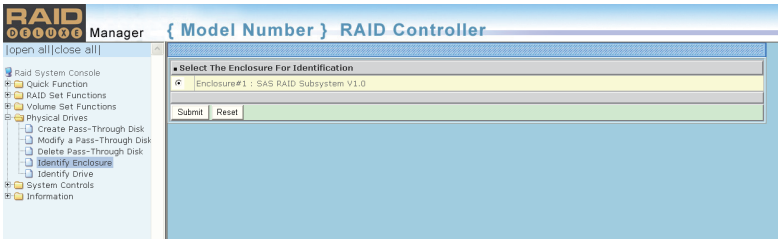
6.7.3 Delete Pass-Through Disk

To delete a pass-through drive from the pass-through drive pool, move the mouse cursor bar to the main menus and click the "Delete Pass Through" link. After you complete the selection, mark the check box for "Confirm The Operation" and click the "Submit" button to complete the delete action.



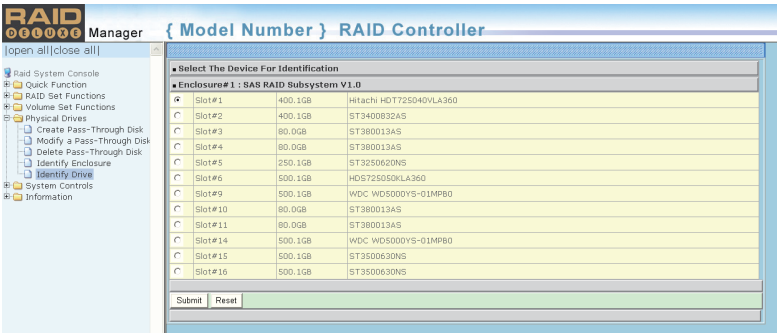
6.7.4 Identify Enclosure

To prevent removing the wrong subsystem, the selected JBOD expander enclosure all disks fault LED indicator will light for physically locating the selected subsystem when the "Identify Subsystem" is selected. This function will also light the subsystem LED indicator, if it is existed.



6.7.5 Identify Drive

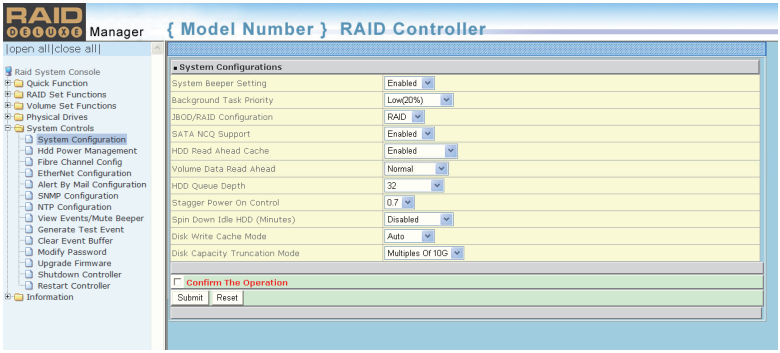
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify Selected Device" is selected.



6.8 System Controls

6.8.1 System Config

To set the RAID system function, move the cursor to the main menu and click the "System Controls" link. The "Raid System Function" menu will show all items, then select the desired function.



- **System Beeper Setting**

The "System Beeper Setting" function is used to "Disabled" or "Enabled" the RAID subsystem alarm tone generator.

- **Background Task Priority**

The "Background Task Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows the user to choose the rebuild priority (UltraLow, Low, Normal and High) to balance volume set access and rebuild tasks appropriately. For high array performance, specify a "Low" value.

- **JBOD/RAID Configuration**

JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

- **SATA NCQ Support**

The controller supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".

- **HDD Read Ahead Cache**

Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.

- **Volume Data Read Ahead**

The "Data Read Ahead" parameter specifies the controller firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must set it from the command line using the "Data Read Ahead" option. The default "Normal" option satisfies the performance requirements for a typical

volume. The "Disabled" value implies no data read ahead. The most efficient value for the controllers depends on your application. "Aggressive" read ahead is optimal for sequential access but it degrades random access.

- **HDD Queue Depth**

This parameter is adjusted the queue depth capacity of NCQ (SATA HDD) or Tagged Command Queuing (SAS) which transmits multiple commands to a single target without waiting for the initial command to complete.

- **Spin Down Idle HDD (Minutes)**

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power.)

- **Disk Write Cache Mode**

A user can set the "Disk Write Cache Mode": Auto, Enabled, or Disabled.

- **Disk Capacity Truncation Mode**

The RAID subsystem uses drive truncation so that drives from differing vendors are more likely to be able to be used as spares for each other. Drive truncation slightly decreases the usable capacity of a drive that is used in redundant units.
The controller provides three truncation modes in the system configuration: **Multiples Of 10G**, **Multiples Of 1G**, and **Disabled**.

Multiples Of 10G: If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. Multiples Of 10G truncates the number under tens. This makes same capacity for both of these drives so that one could replace the other.

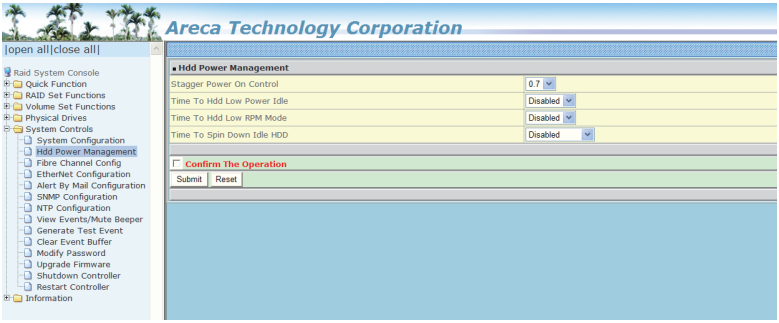
Multiples Of 1G: If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. Multiples

Of 1G truncates the fractional part. This makes capacity for both of these drives so that one could replace the other.

Disabled: It does not truncate the capacity.

6.8.2 Hdd Power Management

Areca has automated the ability to manage HDD power based on usage patterns. The "HDD Power Management" allows you to choose a "Stagger Power On Control", "Low Power Idle", "Low RPM" and completely "Spins Down Idle HDD". It is designed to reduce power consumption and heat generation on idle drives.



6.8.2.1 Stagger Power On Control

In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions. Areca RAID controller has included the option for customer to

select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.

6.8.2.2 Time to Hdd Low Power Idle

This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.

6.8.2.3 Time To Hdd Low RPM Mode

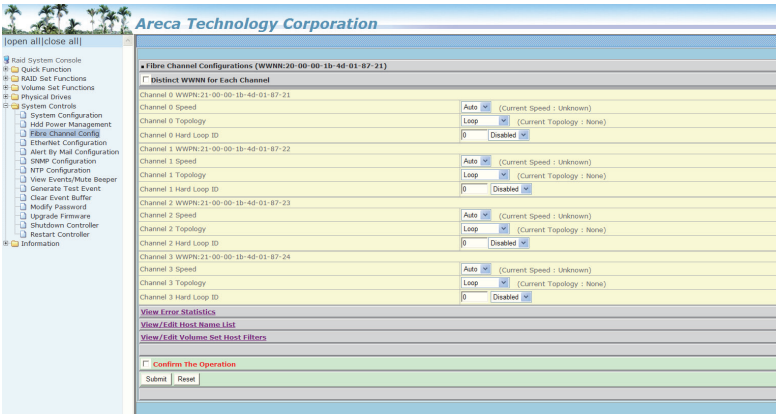
This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.

6.8.2.4 Time To Spin Down Idle HDD

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.

6.8.3 Fibre Channel Config

To set the "Fibre Channel Configuration" function, move the mouse cursor to the main menu and click on the "Fibre Channel Config". The "Fibre Channel Configuration" screen will be shown. Configure the desired function.



• Channel Speed

Fibre Channel is a high-speed robust protocol for managing the transfer of information in storage area networks (SANs). Each channel supports data rates either as 2 Gbps, 4 Gbps, or 8 Gbps. The "Auto" default option is for auto speed negotiation between 2Gbps/4Gbps/8Gbps. The new Channel Speed setting will take effect during the link down/link of the channel. The current channel speed is shown at end of the row. You can click the "Fibre Channel Config" link again from the menu frame to refresh current channel speed negotiation.

• Channel Topology

Each Fibre Channel interconnects nodes using three physical topologies: Fabric, Point-to-Point or Loop. The default Topology is set to "Auto", which takes precedence of Loop Topology. The "Fabric" channel topology is used when there is switch. The "Loop" channel topology is used when there is no switch. The new "Channel Topology" setting will take effect after your controller power cycle again. The current connection topology is shown at end of the row. You can click the "Fibre Channel Config" link again from the menu frame to refresh the current "ChannelTopology" information.

Note:

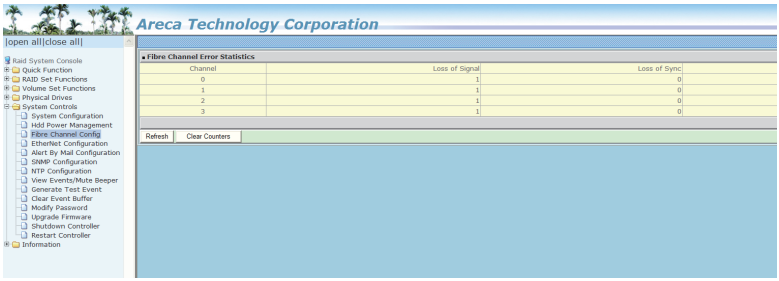
The current topology is shown as "None" when no successful connection is link for the channel.

• Hard Loop ID

This setting is useful for channel "Loop" topology. When enabled, you can manually set the "Hard Loop ID" from 0 to 125 into a logical loop. Make sure this hard assigned ID does not conflict with other devices on the same logical loop; otherwise the channel will be automatically disabled. The "Disable" option is for controller to dynamic configure "the Hard Loop ID" value.

6.8.3.1 View Error Statistics

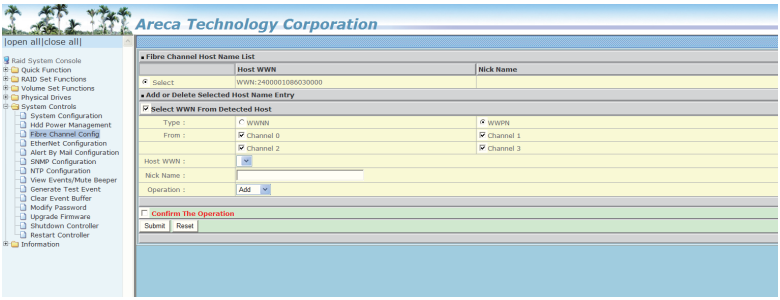
You can also view error statistics for each of the ports. Choose "View Error Statistics" to see a summary of the errors since the last fibre channel reboot. This dialog enumerates the various types of errors detected on a fibre channel port. The numbers indicate the error statistics collected by the fibre channel controller since the last reboot. After selecting "View Error Statistics", use the "Refresh" button to update the display.



6.8.3.2 View/Edit Host Name List

WWN (World Wide Name) is assigned to a port in a Fibre Channel fabric. It uses on SAN, and performs a function equivalent to the MAC address in Ethernet protocol, as it is supposed to be a unique identifier in the network.

To set WWN (World Wide Name) parameter, move the mouse to click on the "View/Edit Host Name List" function of the "Fibre Channel Config". The" Fibre Channel Host Name List" configuration screen will be shown. Using the "Add or Delete Selected Host Name Entry" add or delete the WWNN and WWPN.



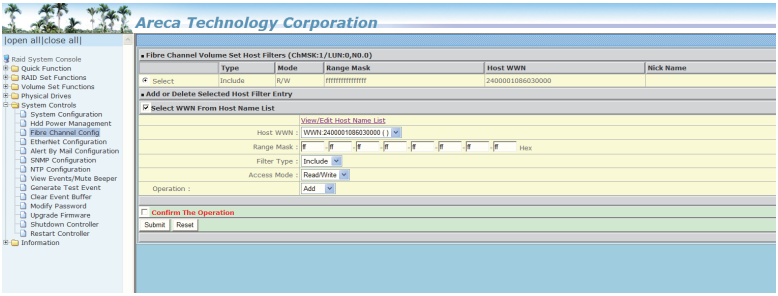
• WWPN (World Wide Port Name)

The fibre channel RAID WWPN uniquely identifies each target port on the subsystem. The host operating system uses the combination of the WWNN and WWPN to uniquely identify a port in the Fabric.

World Wide Node Name (WWNN), a WWN assigned to a node/ device on a Fibre Channel fabric. It is shown at top of the fibre channel RAID subsystem configuration screen. Worldwide Names consist of 16 hexadecimal digits grouped as 8 pairs unique address factory assigned to the FC RAID. It is valid for the same WWNN to be seen on the four ports.

6.8.3.3 View/Edit Volume Set Host Filters

You can define a set of Host Filters for each volume to limit accessibility to certain hosts. When a host logins to the RAID unit, it's WWN will be compared to these Host Filters and access permission map is updated. The subsequent SCSI commands may be rejected according to the access permission.
To set Volume Set Host Filters parameter, move the mouse to click on the "View/Edit Volume Set Host Filters" function of the Fibre Channel Config. The" Fibre Channel Volume Set Host Filters " configuration screen will be shown. Using the "Add or Delete Selected Host Name Entry" add or delete the "Volume Set Host Filters".



Up to 8 entries may be added to the Host Filters with the following operations:

• Specify the Host WWN

This WWN (can be WWNN or WWPN) will be compared with the incoming HBA's WWN for a match. You can select WWN from predefined Host Name List (pull-down menu), or type any WWN directly with "Select WWN From Host Name List" unchecked.

• Specify the Range Mask

The WWN is 64-bit in length. Only the bit positions with Range Mask set as 1 will be compared in the previous step. This is useful to cover multiple ports of a HBA in one single entry. Normally, just leave the Range Mask as all 1's to specify single WWN comparison.

• Specify the Filter Type (Include or Exclude)

Condition-1, all entries in the Host Filters are specified as "Include" => only the matched WWNs in steps 1&2 can access the corresponding volume. All others will be rejected.
Condition-2, all entries in the Host Filters are specified as "Exclude" => the matched WWNs in steps 1&2 will not be able to access the corresponding volume. All others gain full access.
Condition-3, mixed "Include" & "Exclude" entries => this is basically the same as Condition-1, with "Exclude" entries ignored.

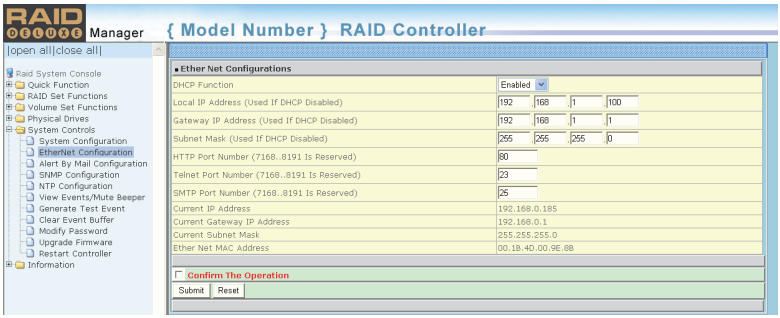
• Specify the Access Mode

Entries with Filter Type specified as "Include" can be further limited as ReadOnly with this option.

• Leave the Operation as "Add". Check "Confirm The Operation" checkbox and then click "Submit" button. An entry is added to this Host Filter set. To delete an entry from the Host Filter, simply select the entry from the listed table, select Operation as "Delete", then check "Confirm The Operation" and click "Submit" button.

6.8.4 iSCSI Configuration

To set the iSCSI Channel Configuration function, move the mouse cursor to the main menu and click on the iSCSI Configuration. The iSCSI Channel Configuration screen will be shown. Configure the desired function.



• Link Aggregation Control Protocol (LACP): It provides a method to control the bundling of several physical ports together to form a single logical channel. LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer (directly connected device that also implements LACP).

• Jumbo Frame (MTU): One of the things to check on in an iSCSI SAN is that all the equipments are set up to allow the use of jumbo frames. For reasons of backwards compatibility, the gigabit Ethernet standard allows the use of the 1500 byte frames in the original 100M Ethernet specification. iSCSI software initiator running at Jumbo frames (9000 MTU) and non-jumbo frames (1500 MTU)

Two types of access control can be applied.

1. Per TargetNode IP filtering
Applied with or without CHAP enabled. Only the specified subrange of IP address can access specific TargetNode.
Setup IP filtering with "iSCSI Configuration => Setup TargetNode Parameters => Allowed IP". The IP subrange notation is similar to CIDR notation as xxx.xxx.xxx.xxx/mm (xxx.xxx.xxx.xxx is the base IP address and mm is # of mask bits). MaskBits is allowed to be 0~32 (instead of 0~30 in CIDR) and specifies bits to be matched from MSB. When mm is set to 0, all IP will match successfully (IP filtering is effectively disabled). When mm is set to 32, only single IP (host) can access the specified TargetNode.

2. Per Initiator TargetNode Mask
Initiator accessibility can be limited to specific subset of TargetNodes with this.

Setup TargetNode Mask with "iSCSI Configuration => Setup Initiator CHAP Secret => TargNode Mask". Click the TargetNodes that can be accessed with the specified Initiator and save the setting.

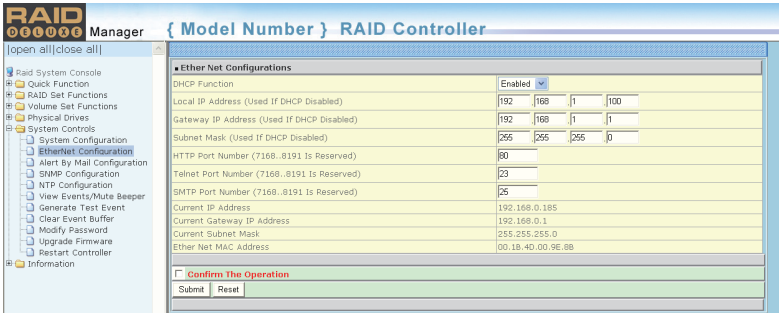
• Data/Header Digest: The header/data digest fields are optional values in the iSCSI header to identify, reject and request retransmission of a corrupt PDU.

• Authentication: The Challenge Handshake Authentication Protocol (CHAP) is a protocol that is used to authenticate the peer of a connection and is based upon the peers sharing a secret (a security key that is similar to a password).

6.8.5 Ethernet Configuration

Use this feature to set the controller Ethernet port configuration. A customer doesn't need to create a reserved space on the arrays before the Ethernet port and HTTP service are working. The firmware-embedded web browser-based RAID manager can access it from any standard internet browser or from any host computer either directly connected or via a LAN or WAN with no software or patches required.

DHCP (Dynamic Host Configuration Protocol) is a protocol that lets network administrators manage centrally and automate the assignment of IP (Internet Protocol) configurations on a computer network. When using the internet's set of protocols (TCP/IP), in order for a computer system to communicate to another computer system, it needs a unique IP address. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to eliminate the work necessary to administer a large IP network.

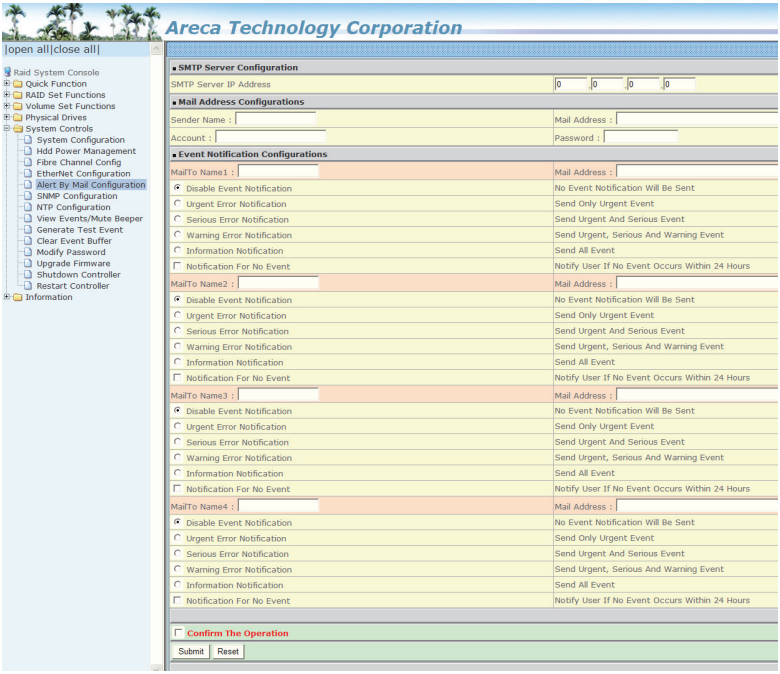


To configure the RAID subsystem's Ethernet port, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the "Ethernet Configuration" item, then press **Enter** key to select the desired function.

6.8.6 Alert By Mail Configuration

To configure the RAID subsystem's e-mail function, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the "Alert By Mail Configuration" item, then select the desired function. This function can only be set via web-based configuration.

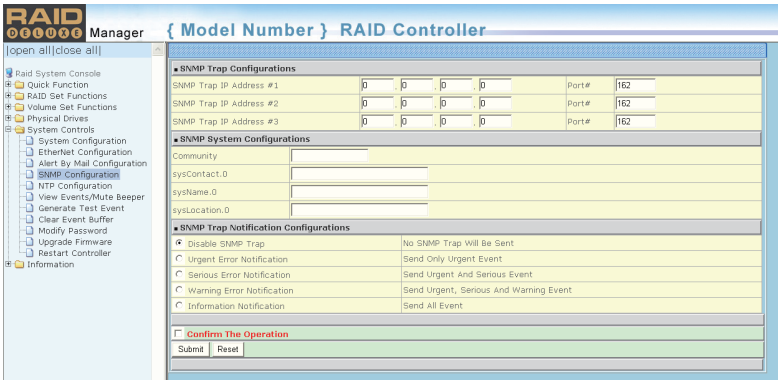
The firmware contains a SMTP manager monitoring all system events. Single or multiple user notifications can be sent via "Plain English" e-mails with no software required.



6.8.7 SNMP Configuration

To configure the RAID subsystem's SNMP function, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the" SNMP Configuration" item, then press **Enter** key to select the desired function. This function can only set by the web-based configuration.

The firmware contains SNMP agent manager monitors all system events and user can use the SNMP function from the web setting with no agent software required. Please refer to Appendix C SNMP Operation & Definition for more detail information about the SNMP trap and definition.



● SNMP Trap Configurations
Enter the SNMP Trap IP Address.

● SNMP System Configurations
About community, Community name acts as a password to screen accesses to the SNMP agent of a particular network device. Type in the community names of the SNMP agent. Before access is granted to a request station, this station must incorporate a valid community name into its request; otherwise, the SNMP agent will deny access to the system.

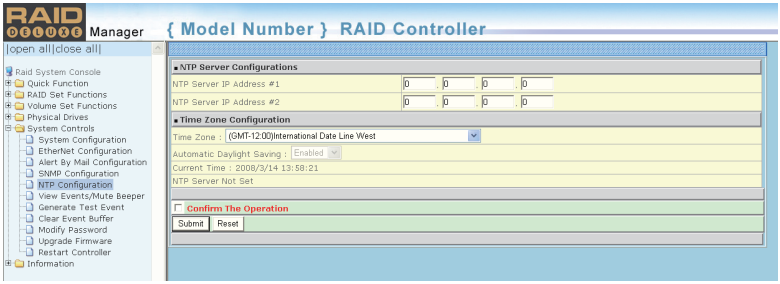
Most network devices use "public" as default of their community names. This value is case-sensitive.

- **SNMP Trap Notification Configurations**

Please refer to Appendix D of Event Notification Table.

6.8.8 NTP Configuration

The Network Time Protocol (NTP) is used to synchronize the time of a computer client or server to another server or reference time source, such as a radio or satellite receiver or modem. It provides accuracies typically within a millisecond on LANs and up to a few tens of milliseconds on WANs relative to Coordinated Universal Time (UTC) via a Global Positioning Service (GPS) receiver, for example:



Note:

NTP feature works through onboard Ethernet port. So you must make sure that you have connected onboard Ethernet port.

- **NTP Sever Address**

The most important factor in providing accurate, reliable time is the selection of NTP servers to be used in the configuration file. Typical NTP configurations utilize multiple redundant servers and diverse network paths in order to achieve high accuracy and reliability. Our NTP configuration supports two existing public NTP synchronization subnets.

- **Time Zone**

Time Zone conveniently runs in the system tray and allows you to easily view the date and time in various locations around the world. You can also quickly and easily add your own personal locations to customize time zone the way you want.

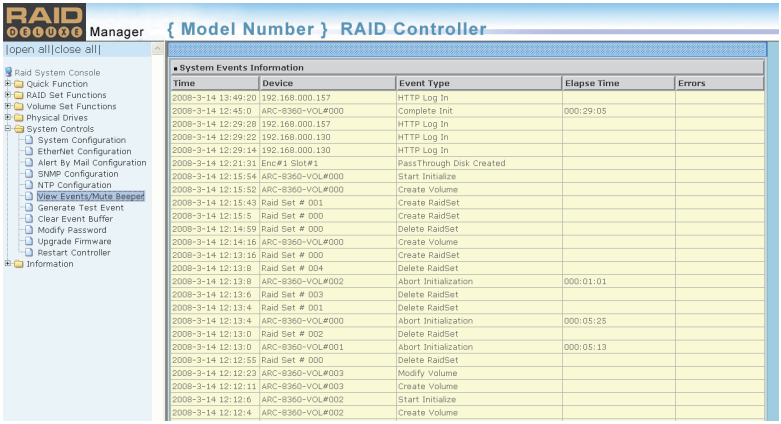
- **Automatic Daylight Saving**

Automatic Daylight Saving will normally attempt to automatically adjust the system clock for daylight saving changes based on the computer time zone. This tweak allows you to disable the automatic adjustment.

6.8.9 View Events/Mute Beeper

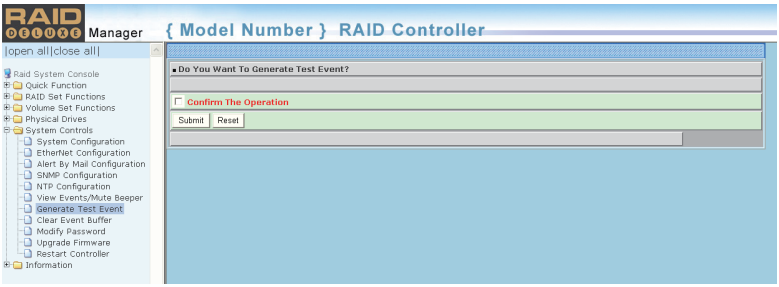
To view the RAID subsystem's event information, click on the "View Event/Mute Beeper" link. The RAID subsystem's "System events Information" screen appears. The mute beeper function automatically enable by clicking on "View Events/Mute Beeper".

Select this option to view the system events information: Timer, Device, Event Type, Elapse Time and Errors. The RAID subsystem does not have a built-in real time clock. The time information is the relative time from the system time setting. The maximum event no. is 256 per controller.


RAID DELUXE
Manager
{ Model Number } RAID Controller
|open all|close all|
Raid System Console
Quick Function
RAID Set Functions
Volume Set Functions
Physical Drives
System Controls
System Configuration
Ethernet Configuration
Alert By Mail Configuration
SNMP Configuration
NTP Configuration
View Events/Mute Beeper
Generate Test Event
Clear Event Buffer
Modify Password
Upgrade Firmware
Restart Controller
Information
System Events Information
Time
Device
Event Type
Elapse Time
Errors
2008-3-14 13:49:20 192.168.000.157 HTTP Log In
2008-3-14 12:45:0 ARC-8360-VOL#000 Complete Init 000:29:05
2008-3-14 12:29:28 192.168.000.157 HTTP Log In
2008-3-14 12:29:22 192.168.000.130 HTTP Log In
2008-3-14 12:29:14 192.168.000.130 HTTP Log In
2008-3-14 12:21:31 Enc#1 Slot#1 PassThrough Disk Created
2008-3-14 12:15:54 ARC-8360-VOL#000 Start Initialize
2008-3-14 12:15:52 ARC-8360-VOL#000 Create Volume
2008-3-14 12:15:43 Raid Set # 001 Create RaidSet
2008-3-14 12:15:5 Raid Set # 000 Create RaidSet
2008-3-14 12:14:59 Raid Set # 000 Delete RaidSet
2008-3-14 12:14:16 ARC-8360-VOL#000 Create Volume
2008-3-14 12:13:16 Raid Set # 000 Create RaidSet
2008-3-14 12:13:8 Raid Set # 004 Delete RaidSet
2008-3-14 12:13:8 ARC-8360-VOL#002 Abort Initialization 000:01:01
2008-3-14 12:13:6 Raid Set # 003 Delete RaidSet
2008-3-14 12:13:4 Raid Set # 001 Delete RaidSet
2008-3-14 12:13:4 ARC-8360-VOL#000 Abort Initialization 000:05:25
2008-3-14 12:13:0 Raid Set # 002 Delete RaidSet
2008-3-14 12:13:0 ARC-8360-VOL#001 Abort Initialization 000:05:13
2008-3-14 12:12:55 Raid Set # 000 Delete RaidSet
2008-3-14 12:12:23 ARC-8360-VOL#003 Modify Volume
2008-3-14 12:12:11 ARC-8360-VOL#003 Create Volume
2008-3-14 12:12:6 ARC-8360-VOL#002 Start Initialize
2008-3-14 12:12:4 ARC-8360-VOL#002 Create Volume

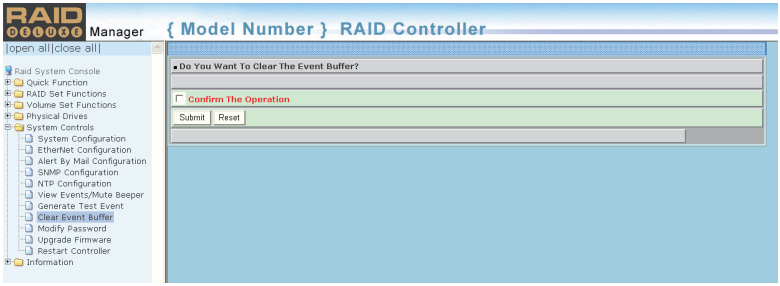
6.8.10 Generate Test Event

Use this feature to generate events for testing purposes. Such as test mail or SNMP trap settings.



6.8.11 Clear Events Buffer

Use this feature to clear the entire events buffer information.

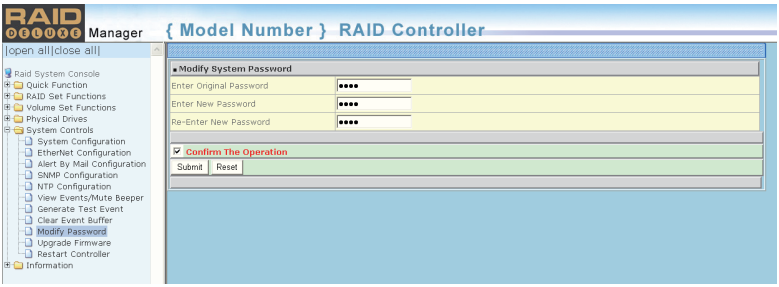


6.8.12 Modify Password

To set or change the RAID subsystem's password, select "System Controls" from the menu and click on the "Modify Password" link. The "Modify System Password" screen appears.

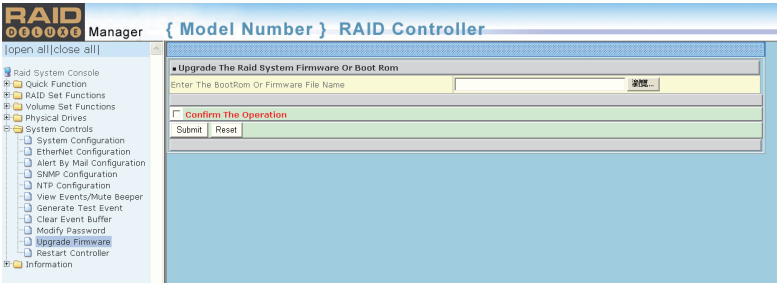
The manufacture default password is set to 0000.
The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized entry. The controller will check the password only when entering the main menu from the initial screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command in 5 minutes. Do not use spaces when you enter the password, if spaces are used, it will lock out the user.

To disable the password, leave the fields blank. Once the user confirms the operation and clicks the "Submit" button, the existing password will be cleared. Then, no password checking will occur when entering the main menu from the starting screen.



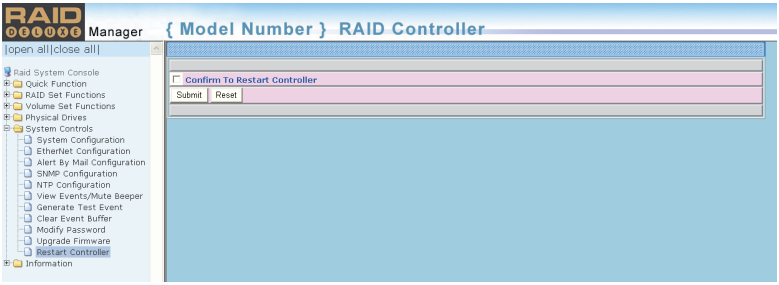
6.8.13 Update Firmware

Please refer to the Appendix A Upgrading Flash ROM Update Process.



6.8.14 Restart Controller

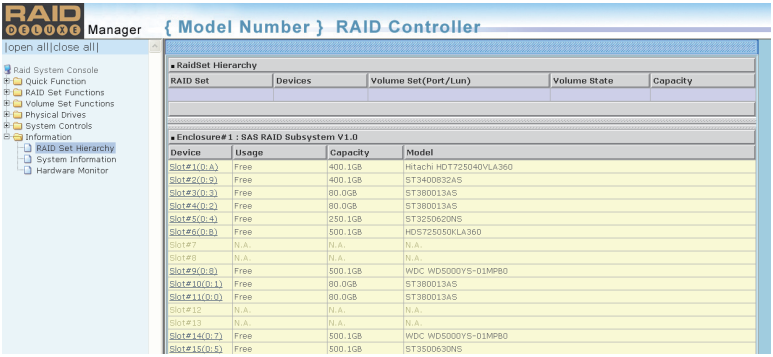
Use the "Restart Controller" function to restart the RAID controller. Without powering off the subsystem.



6.9 Information

6.9.1 Raid Set Hierarchy

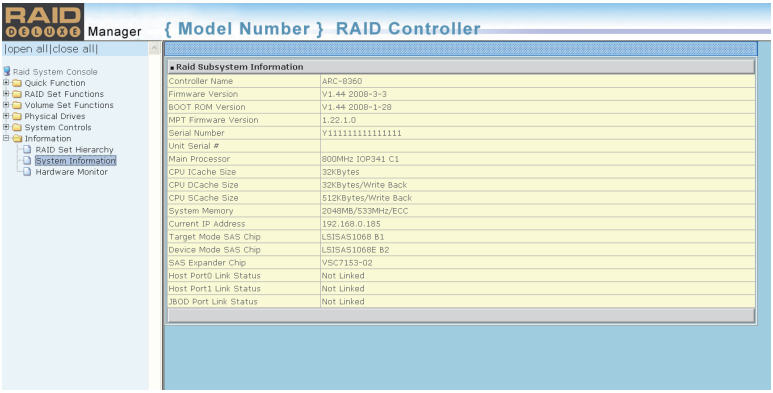
Use this feature to view the RAID subsystem current RAID set, current volume set and physical disk information. The volume state and capacity are also shown in this screen.



6.9.2 System Information

To view the RAID subsystem's system information, move the mouse cursor to the main menu and click on the "System Information" link. The RAID subsystem's "RAID Subsystem Information" screen appears.

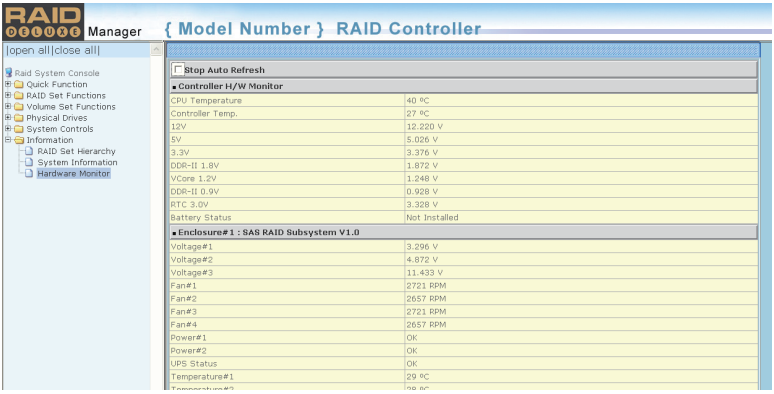
Use this feature to view the RAID subsystem's system information. The controller name, controller firmware version, Boot ROM version, SAS firmware version, serial number, main processor, CPU data/instruction cache size, system memory size/speed and current IP address appear in below screen.



The controller provides two four-link SFF-8088 connector for the host and one four-link connector SFF-8088 for JBOD. It may has problem between the host/JBOD and controller. The "Host Port# Link" provides current working port link status. The option for port link is defined below.
Not Linked → Fail or no link to host/JBOD
1x600 → Single-link for use
2x600 → Two-link for use
4x600 → Four-link for use

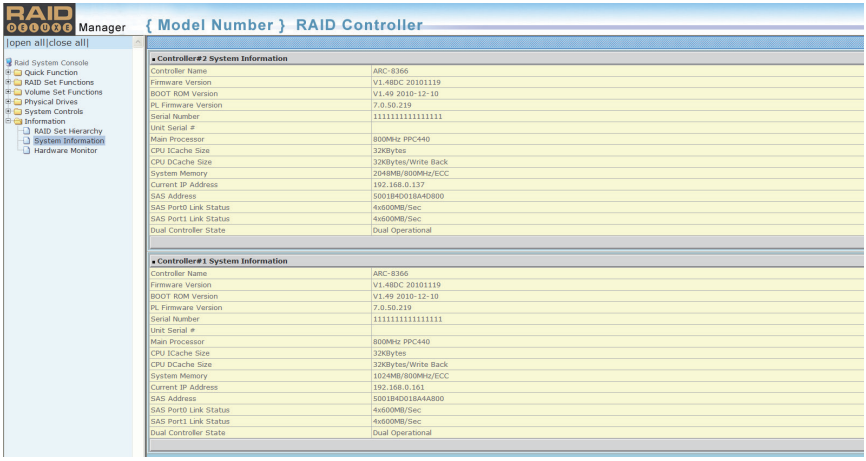
6.9.3 Hardware Monitor

The hardware monitor information of the subsystem attached in this controller is also shown on this screen.



7. Assigning Volume to Dual Controllers

The controllers are identified by a Ctrl1 or Ctrl2 designation and, where applicable, a system device name. The Ctrl1 and Ctrl2 are relative names to identify the controllers. All configuration options can be accessed through the Ctrl1 or Ctrl2 RAID controller. The RAID controller installed in the lower controller slot is the Ctrl1 controller. The dual controller's firmware shows both controllers' host channels on the volume port mapping even only one controller existed. The "Dual Controller State" on the "System Information" shows the RAID subsystem working on "Dual Operational" controllers or "Single Operational" controller. The following "System Information" screen shows two controllers on the RAID subsystem.



The following table is shown as the channels assigned by the Ctrl1 and Ctrl2 on the web browser manager.

	Ctrl1	**Ctrl2**
SAS Host Channel#	0 and 1	2 and 3
Fibre Host Channel#	0, 1, 2 and 3	4, 5, 6 and 7
iSCSI Host Channel#	0, 1, 2 and 3	4, 5, 6 and 7

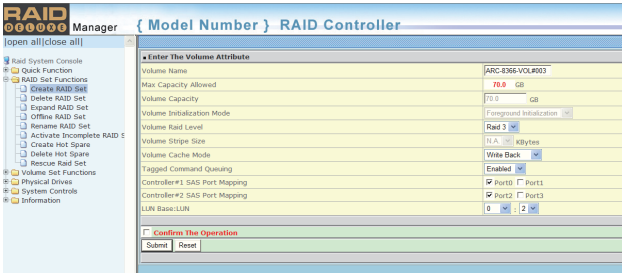
7.1 Dual Independent Mode

If your dual controller subsystem is operating with "Dual Independent Mode", the synchronized cache communication action will be disabled. Your subsystem can be separated the volumes to each individual controllers. This increases array performance for total subsystems that operate one volume groups to one controller and other volume groups to other controller. Using "Dual Independent Mode" operation offers greater throughput and therefore better performance. Your subsystem can be spared the effort to mirror and transfer data between partner controllers. This increases array performance for subsystems that operate without write-caching.

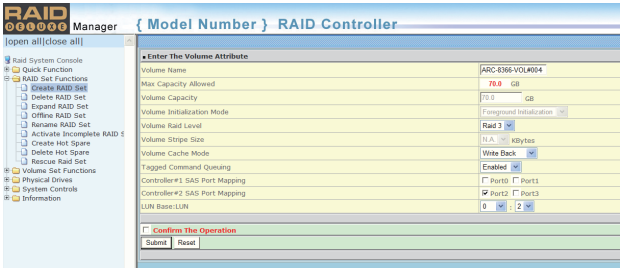
7.1.1 Mapping a Volume to the Host LUNs

When controllers are successfully installed, volume set is created and mapped to either controller channels. Each volume is available through one controller host port LUNs. This kind of volume will work under independent controller mode.

The following volume attribute setting is the volume channel host mapping example for Ctrl1 only on independent mode.



The following volume attribute setting is the volume channel host mapping example for Ctrl2 only on independent mode.



7.2 Dual Redundant Mode

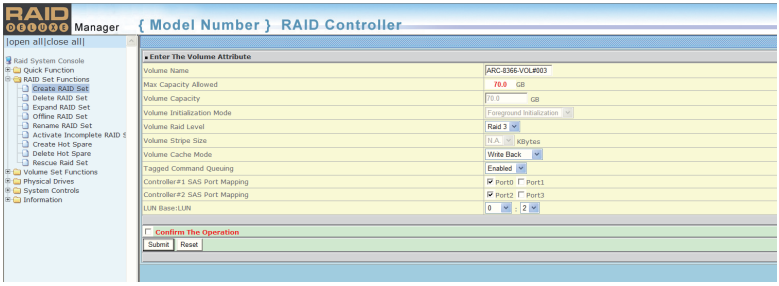
The redundant controllers communicate with each other via a dedicated high-speed serial bus on the common backplane. This bus is automatically formed when the two controller carriers are joined together. While in "Dual Redundant Mode", a failed controller automatically shifts I/O functions to the counterpart controller. Controller failover and failback are transparent to the host. The controller itself is hot-swappable for full non-stop redundant operation. The dual controller's cache data are always synchronized for maintaining cache coherency. Each controller saves an exact replica of the cache content on its counterpart. In the event of one controller failure, the unfinished writes will be completed by the existing controller.

The backplane holds two separated hot-swap connector for the main controller board. When two controllers are in a redundant configuration and one controller fails, it can be easily hot swapped online without shutting the subsystem down.

7.2.1 Mapping a Volume to the Host LUNs

When controllers are successfully combined, volume set is created and mapped to both controller channels (Ctrl1 & Ctrl2). This kind of volume will work under dual redundant controller mode. Each volume is available through both controller host port LUNs under "Active-to-Active" or "Active-to-Standby" configuration.

The following volume attribute setting is the volume channel host mapping example for dual redundant controller mode.



When a ARC-8366-VOL#003 is created and mapped to both Ctrl1 and Ctrl2 host channels, this volume will work under "Active-to-Active" or "Active-to-Standby" configuration.

7.2.2 Active-to-Active Configuration

Active-to-Active arrays use two controllers to service read/write requests to the same LUN. The use of two active controllers gives a number of benefits, the primary being the ability to load balance I/O to the array-using host-based software.

7.2.3 Active-to-Standby Configuration

Active-to-Standby configurations will have a LUN "owned" by one of dual redundant controllers. When the controller which owns a LUN fails or the host loses access to that controller, the other (standby) controller takes ownership of the LUN and host IO is then serviced from this new controller.

7.3 Forcing Controller Failover for Testing

There are 2 methods to test/simulate dual redundant controller failure. Those methods are performed for testing the dual redundant controller functionality before any critical data is committed to the drives. Testing the failover functionality can be performed using the following methods.

7.3.1 Pulling out one of the controllers from the carrier

If the one of the active controller is physically removed from the carrier, a switchover will occur and take over the I/Os jobs of the failed controller.

(1). Loosen the thumbscrew on either any of the two controller carriers. Pull out the lever slowly and the alert beeper indicates controller failure. The existing controller will then act as both controllers and take over the I/Os jobs.

(2). Unplug all interface cables on the "failed" controller and pull

out the controller carrier from the slot.

(3). Reinsert the replacement controller.

(4). Reconnect all cables and tighten the thumbscrew of the controller carrier.

The existing controller should automatically attempt to form with the replacement controller. When the initialization process of the replacement controller is completed, the alert beeper will be off. Both controllers will be back all the services provided for the RAID subsystem.

7.3.2 Manual switchover request

A user can initiate a manual switchover request from the web browser manager to force one controller failure.

(1). Login to the testing emulation failed controller web browser GUI.

(2). Under "Raid Set Functions" main menu, select "Rescue Raid Set".

(3). In the text box provided, enter the command "HaltCtrl0". Tick "Confirm The Operation" and click "Submit" button.

(4). The web browser GUI will show "Controller Will Be Halted In 6 Seconds".
a. You may now pull out the controller you had just disabled. I/Os job should be continued by the existing controller. Continue the aforementioned procedure to complete the test.
Or
b. In the text box provided on the existing controller "Rescue Raid Set" function, enter the command "Restart". Tick "Confirm The Operation" and click "Submit" button. The existing controller should automatically attempt to combine with the emulation failed controller. When the initialization process of the emulation failed controller is completed, the failed controller Fault LED will be off. Both controllers will be back to normal operational mode.

Appendix A

Upgrading Flash ROM Update Process

Since the RAID subsystem features flash firmware, it is not necessary to change the hardware flash chip in order to upgrade the RAID firmware. The user can simply re-program the old firmware through the RS-232 port or LAN Port. New releases of the firmware are available in the form of a DOS file at OEM's FTP. The file available at the FTP site is usually a self-extracting file that contains the following:

ARC-NNNNXXXX.BIN Firmware Binary (where NNNN refers to the model name and "XXXX" refers to the function name:BOOT, FIRM and MBR0)
ARC-8x66BOOT.BIN:→ RAID subsystem hardware initialization.
ARC-8x66FIRM.BIN:→ RAID kernal program
ARC-8x66MBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the RAID subsystem.

Release_note.txt file contains the history information of the firmware change. Read this file first before upgrading the firmware. These files must be extracted from the compressed file and copied to one directory in drive A: or C:.

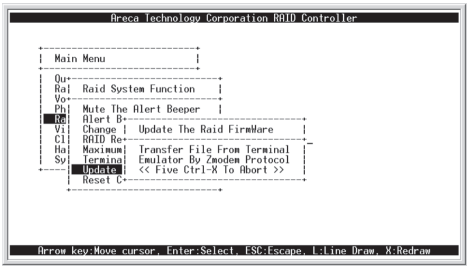
Establishing the Connection for the RS-232

The firmware can be downloaded to the RAID subsystem controller by using an ANSI/VT-100 compatible terminal emulation program or HTTP web browser management. You must complete the appropriate installation procedure before proceeding with this firmware upgrade. Please refer to chapter 4.3, "VT100 terminal (Using the controller's serial port)" for details on establishing the connection. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol.

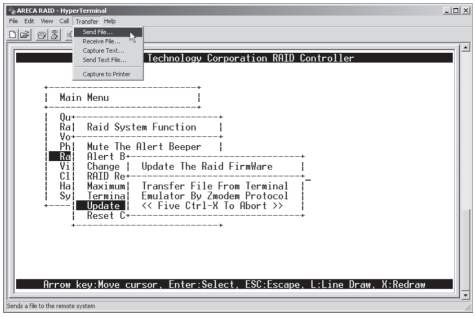
Upgrade Firmware Through ANSI/VT-100 Terminal Emulation

Get the new version firmware for your RAID subsystem controller. For example, download the bin file from your OEM's web site onto the c:

1. From the main menu, scroll down to "Raid System Function"
2. Choose the "Update Firmware", The "Update The Raid Firmware" dialog box appears.

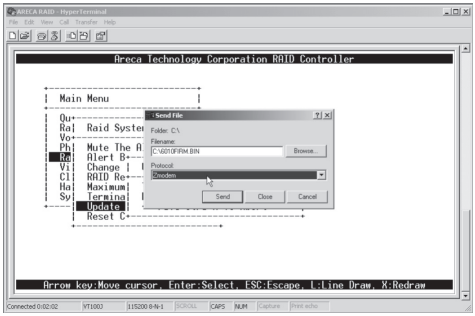


3. Go to the tool bar and select "Transfer". Open "Send File".

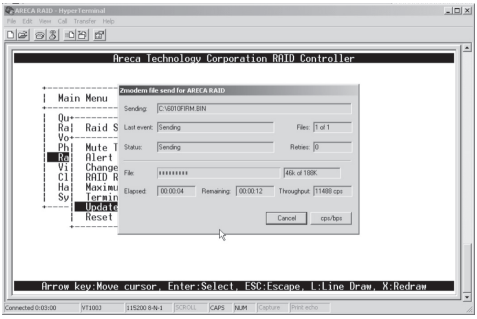


4. Select "ZMODEM modem" under Protocol. ZMODEM as the file transfer protocol of your terminal emulation software.

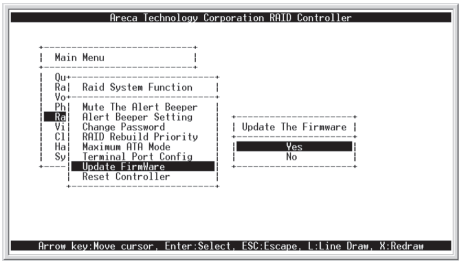
5. Click "Browse". Look in the location where the firmware upgrade software is located. Select the file name:



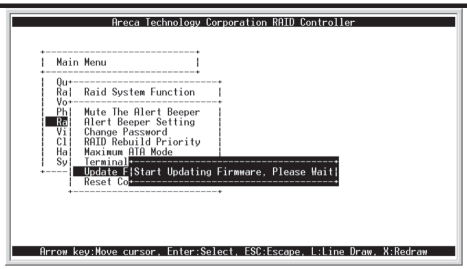
6. Click "Send", to send the firmware binary to the controller.



7. When the Firmware completes downloading, the confirmation screen appears. Press **Yes** to start program the flash ROM.

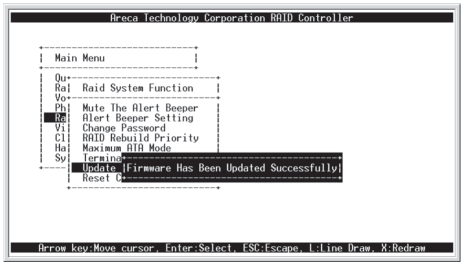


8. When the Flash programming starts, a bar indicator will show "Start Updating Firmware. Please Wait".



9. The Firmware upgrade will take approximately thirty seconds to complete.

10. After the Firmware upgrade is complete, a bar indicator will show "Firmware Has Been Updated Successfully".



Note:

1. The user doesn't need to reconfigure all of the settings after the firmware upgrade is complete, because all of the settings will keep the values before upgrade.
2. Please update all binary code (BOOT, FIRM and MBR0) before you reboot the RAID subsystem. Otherwise, a mixed firmware package may hang the RAID subsystem.

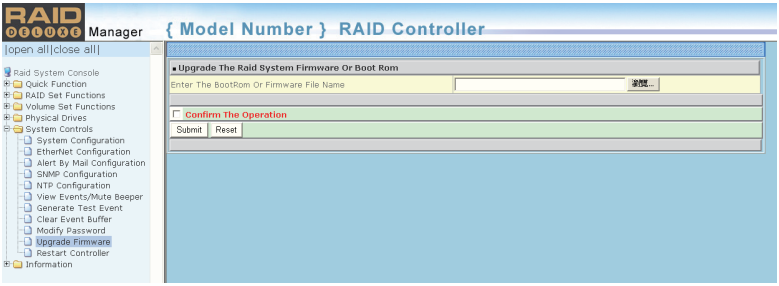
Upgrade Firmware Through Web Browser Manager (LAN Port)

Get the new version firmware for your RAID subsystem. For example, download the bin file from your OEM's web site onto the c:

1. To upgrade the RAID subsystem firmware, move the mouse cursor to "Upgrade Firmware" link. The "Upgrade The Raid System Firmware" screen appears.

2. Click "Browse". Look in the location where the firmware upgrade file is located. Select the file name:
"ARC-NNNNXXXX.BIN" and click open.

3. Click the "Confirm The Operation" and press the "Submit" button.



4. The Web Browser begins to download the firmware binary to the controller and start to update the flash ROM.

5. After the firmware upgrade is complete, a bar indicator will show "Firmware has Been Updated Successfully"

Note:

1. The user doesn't need to reconfigure all of the settings after the firmware upgrade is complete, because all of the settings will keep us the vaules before upgrade.
2. Please update all binary code (BOOT, FIRM and MBR0) before you reboot the RAID subsystem. Otherwise, a mixed firmware package may hang the RAID subsystem.

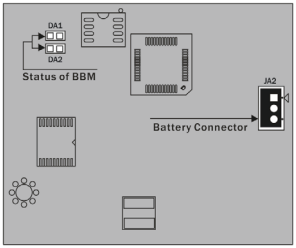
Appendix B

Battery Backup Module (ARC8006-2)

The RAID subsystem operates using cache memory. The Battery Backup Module is an add-on module that provides power to the RAID subsystem cache memory in the event of a power failure. The BBM monitors the write back cache on the RAID subsystem, and provides power to the cache memory if it contains data not yet written to the hard drives when power failure occurs.

BBM Connector and Components

This section provides the BBM add-on module layout and connector for battery pack.

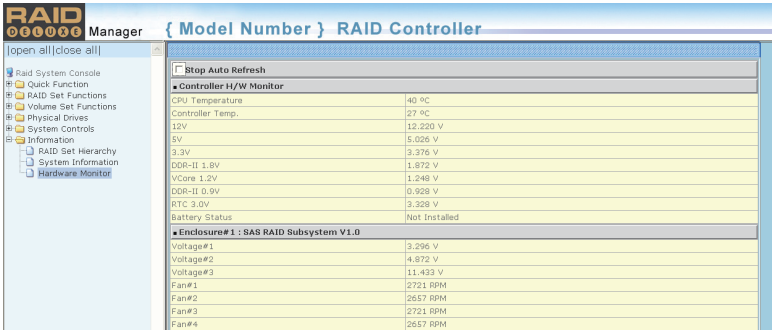


- DA1 (Green) : light when BBM charged down
- DA2 (Red) : light when BBM charging

Battery Pack Outlines

Status of BBM

The BBM status will be shown on the web browser of "Hardware Monitor Information" screen.



Installation BBM Module

1. Make sure all power to the RAID subsystem is disconnected.

2. Install the “six eaves copper pillars-M3x6mm” on the RAID controller mounting position (NH7) and secures it using “round head screw” for ARC8006-2 add-on module.

3. Install the “six eaves copper pillars-M3x23mm” on the three mounting position (NH2,NH3 and NH8) and secures it using “round head screws” for battery pack.

4. Install ARC8006-2 add-on module so that JA1 on the backside connector to J7 on the SAS RAID controller connector.

5. Integrators provide pre-drilled hole (MHA1) in ARC8006-2 add-on module for securing the “six eaves copper pillars” on the RAID controller using “round head screw”.

6. Connect the battery pack cable to the JA2 3-pin box header battery connector on the ARC8006-2 add-on module.

7. Integrators provide pre-drilled holes in battery pack for securing the “six eaves copper pillars” on the RAID controller using “round head screws”.

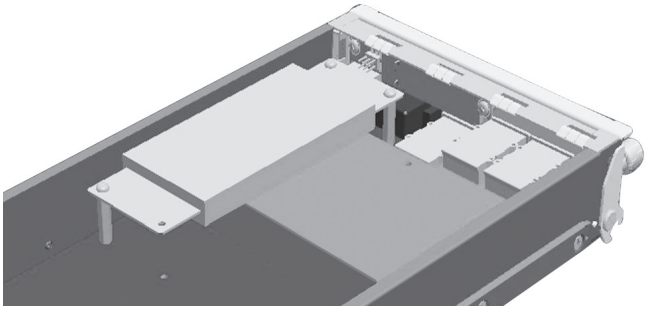


Figure 1-1, RAID controllers connect to battery

Battery Backup Capacity

Battery backup capacity is defined as the maximum duration of a power failure for which data in the cache memory can be maintained by the battery. The BBM's backup capacity varied with the memory chips that installed on the RAID subsystem.

Operation

1. Battery conditioning is automatic. There are no manual procedures for battery conditioning or preconditioning to be performed by the user.
2. In order to make sure of all the capacity is available for your battery cells, allow the battery cell to be fully charged when installed for the first time. The first time charge of a battery cell takes about 24 hours to complete.
3. Set the "Disk Write Cache Mode": Auto, if "Disk Write Cache" option does not set on the "Auto".
4. Set the volume set "Cache Mode": Write-Back Cache.

Battery Functionality Test Procedure

1. Write amount of data into controller volume, about 5GB or bigger.
2. Waiting for few seconds, power failed system by remove the power cable.
3. Check the battery status, battery beeps every few seconds.
4. Power on system, and login in the SAS RAID subsystem.
5. Check the controller event log, make sure the event shows controller boot up with power recovered.

Changing the Battery Backup Module

At some point, the LI-ION battery will no longer accept a charge properly. LI-ION battery life expectancy is anywhere from approximately 1 to 5 years.

1. Power down the SAS RAID subsystem properly. Make sure that cache memory has been flushed.
2. Pull the SAS RAID controller caddy out from the slot.
3. Release the " round head screws" on the NH2, NH3 and NH8 "six eaves copper pillars".
4. Disconnect the battery pack cable from JA2 on the ARC-8006-2 add-on module connector.
5. Install a new battery pack and connect the new battery pack cable to JA2 connector.
6. Secure the " round head screws" on the NH2, NH3 and NH8 "six eaves copper pillars".
7. Push the RAID controller caddy into the slot.

BBM Specifications

Mechanical
• Module Dimension (W x H x D)
ARC-8006-2: 45 x 7 x 53 mm
Battery Pack: 48.5 x 9 x 146 mm

Environmental
• Operating Temperature
Temperature: 0^{O} C to $+40^{O}$ C
Humidity: 45-85%, non-condensing

• Storage Temperature
Temperature: -40^{O} C to 60^{O} C
Humidity: 45-85%, non-condensing

• Electrical
Input Voltage:+3.8VDC

• On Board Battery Capacity
3000mAH (3*1000mAH)

Appendix C

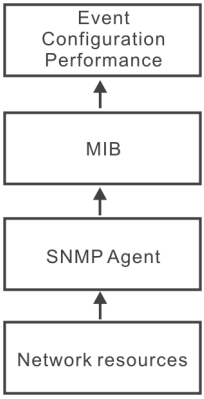
SNMP Operation & Definition

Overview

The external RAID subsystem firmware-embedded Simple Network Management Protocol (SNMP) agent for the connect array. An SNMP-based management application (also known as a SNMP manager) can monitor the disk array. An example of a SNMP management application is Hewlett-Packard's Open View. The firmware-embedded SNMP agent ca be used to augment the RAID subsystem if you are already running a SNMP management application at your site.

SNMP Definition

SNMP, an IP-based protocol, has a set of commands for getting the status of target devices. The SNMP management platform is called the SNMP manager, and the managed devices have the SNMP agent loaded. Management data is organized in a hierarchical data structure called the management Information Base (MIB). These MIBs are defined and sanctioned by various industry associations. The objective is for all vendors to create products in compliance with these MIBs so that inter-vendor interoperability can be achieved. If a vendor wishes to include additional device information that is not specified in a standard MIB, then that is usually done through MIB extensions.



SNMP Installation

The installation of the SNMP manager is accomplished in several phases:

- Installing the SNMP manager software on the client
- Placing a copy of the management information base (MIB) in a directory which is accessible to the management application
- Compiling the MIB description file with the management application

MIB Compilation and Definition File creation

Before the manager application accesses the RAID subsystem, user needs to integrate the MIB into the management application's database of events and status indicator codes. This process is known as compiling the MIB into the application. This process is highly vendor-specific and should be well-covered in the User's Guide of your SNMP application. Ensure the compilation process successfully integrates the contents of the areca_sas.mib file into the traps database.

Location for MIB

Depending upon the SNMP management application used, the MIB must be placed in a specific directory on the network management station running the management application. The MIB file must be manually copied to this directory. For example:

SNMP Management Application	MIB Location
HP OpenView	\OV\MIBS
Netware NMS	\NMS\SNMPMIBS\CURRENT

Your management application may have a different target directory. Consult the management application's user manual for the correct location.

Appendix D

Event Notification Configurations

The controller classifies disk array events into four levels depending on their severity. These include level 1: Urgent, level 2: Serious, level 3: Warning and level 4: Information. The level 4 covers notification events such as initialization of the controller and initiation of the rebuilding process; Level 2 covers notification events which once have happen; Level 3 includes events which require the issuance of warning messages; Level 1 is the highest level, and covers events the need immediate attention (and action) from the administrator. The following lists sample events for each level:

A. Device Event

Event	Level	Meaning	Action
Device Inserted	Warning	HDD inserted	
Device Removed	Warning	HDD removed	
Reading Error	Warning	HDD reading error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Writing Error	Warning	HDD writing error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
ATA Ecc Error	Warning	HDD ECC error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Change ATA Mode	Warning	HDD change ATA mode	Check HDD connection
Time Out Error	Warning	HDD time out	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Device Failed	Urgent	HDD failure	Replace HDD
PCI Parity Error	Serious	PCI parity error	If only happen once, it may be caused by noise. If always happen, please check power supply or contact to us.
Device Failed(SMART)	Urgent	HDD SMART failure	Replace HDD

PassThrough Disk Created	Inform	Pass Through Disk created	
PassThrough Disk Modified	Inform	Pass Through Disk modified	
PassThrough Disk Deleted	Inform	Pass Through Disk deleted	

B. Volume Event

Event	Level	Meaning	Action
Start Initialize	Warning	Volume initialization has started	
Start Rebuilding	Warning	Volume rebuilding has started	
Start Migrating	Warning	Volume migration has started	
Start Checking	Warning	Volume parity checking has started	
Complete Init	Warning	Volume initialization completed	
Complete Rebuild	Warning	Volume rebuilding completed	
Complete Migrate	Warning	Volume migration completed	
Complete Check	Warning	Volume parity checking completed	
Create Volume	Warning	New volume created	
Delete Volume	Warning	Volume deleted	
Modify Volume	Warning	Volume modified	
Volume Degraded	Urgent	Volume degraded	Replace HDD
Volume Failed	Urgent	Volume failure	
Failed Volume Revived	Urgent	Failed volume revived	
Abort Initialization	Warning	Initialization been abort	
Abort Rebuilding	Warning	Rebuilding aborted	
Abort Migration	Warning	Migration aborted	
Abort Checking	Warning	Parity check aborted	
Stop Initialization	Warning	Initialization stopped	
Stop Rebuilding	Warning	Rebuilding stopped	
Stop Migration	Warning	Migration stopped	
Stop Checking	Warning	Parity check stopped	

C. RAID Set Event

Event	Level	Meaning	Action
Create RaidSet	Warning	New RAID set created	
Delete RaidSet	Warning	Raidset deleted	
Expand RaidSet	Warning	Raidset expanded	
Rebuild RaidSet	Warning	Raidset rebuilding	
RaidSet Degraded	Urgent	Raidset degraded	Replace HDD

D. Hardware Monitor Event

Event	Level	Meaning	Action
DRAM 1-Bit ECC	Urgent	DRAM 1-Bit ECC error	Check DRAM
DRAM Fatal Error	Urgent	DRAM fatal error encountered	Check the DRAM module and replace with new one if required.
Controller Over Temperature	Urgent	Abnormally high temperature detected on controller (over 60 degree)	Check air flow and cooling fan of the subsystem, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd (over 55 degree)	Check air flow and cooling fan of the subsystem.
Fan Failed	Urgent	Cooling Fan # failure or speed below 1700RPM	Check cooling fan of the subsystem and replace with a new one if required.
Controller Temp. Recovered	Serious	Controller temperature back tonormal level	
Hdd Temp. Recovered			
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backuped	
Incomplete RAID Discovered	Serious	Some RAID set member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	

Telnet Log	Serious	a Telnet login detected	
InVT100 Log In	Serious	a VT100 login detected	
API Log In	Serious	a API login detected	
Lost Rebuilding/ MigrationLBA	Urgent	Some rebuilding/ migration raidset member disks missing before power on.	Reinserted the missing member disk back, controller will continued the incompleted rebuilding/migration.

Appendix E

RAID Concept

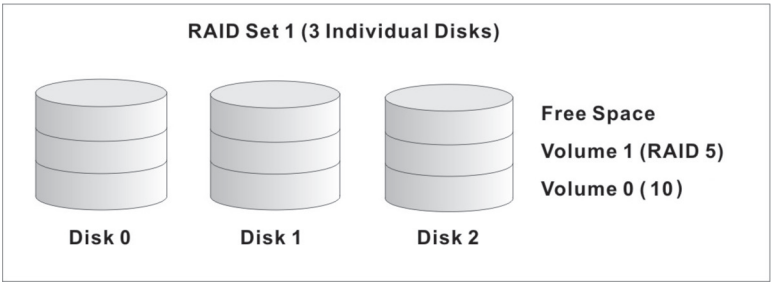
RAID Set

A RAID set is a group of disk containing one or more volume sets. It has the following features in the RAID subsystem. A volume Set must be created either on an existing RAID set or on a group of available individual disks (disks that are not yet a part of an RAID set). If there are pre-existing RAID sets with available capacity and enough disks for specified RAID level desired, then the volume set will be created in the existing RAID set of the user's choice. If physical disk of different capacity are grouped together in a RAID set, then the capacity of the smallest disk will become the effective capacity of all the disks in the RAID set.

Volume Set

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set.

In the illustration below, volume 1 can be assigned a RAID 5 level of operation while volume 0 might be assigned a RAID 0+1 level of operation.



Easy of Use Features

• Instant Availability/Background

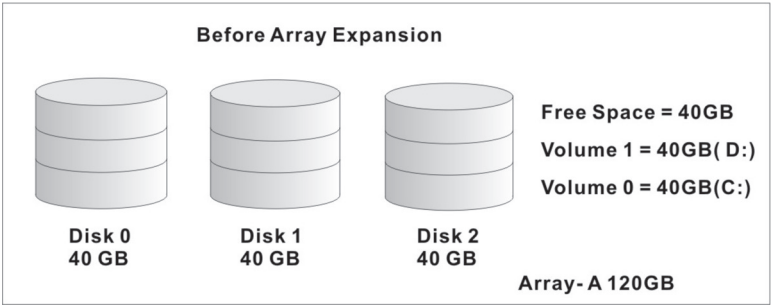
Initialization RAID 0 and RAID 1 volume set can be used immediately after the creation. But the RAID 3 and 5 volume sets must be initialized to generate the parity. In the Normal Initialization, the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. Furthermore, the RAID volume set is also protected against a single disk failure while initializing. In Fast Initialization, the initialization proceeds must be completed before the volume set ready for system accesses.

• Online Array Roaming/Offline RAID set

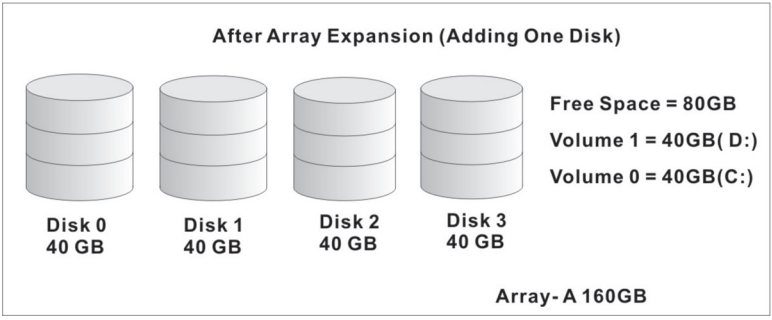
The RAID subsystem stores configuration information on the disk drives It can protect the configuration settings in case of a disk drive or controller failure. Array roaming allows the administrators the ability to move a completely RAID set to another system without losing RAID configuration and data on that RAID set. If a server fails to work, the RAID set disk drives can be moved to another server and inserted in any order.

• Online Capacity Expansion

Online Capacity Expansion makes it possible to add one or more physical drive to a volume set, while the server is in operation, eliminating the need to store and restore after reconfigured the RAID set. When disks are added to a RAID set, unused capacity is added to the end of the RAID set. Data on the existing volume sets residing on that RAID set is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can create additional volume set. The expansion process is illustrated as following figure.



The RAID subsystem redistributes the original volume set over the original and newly added disks, using the same fault-tolerance configuration. The unused capacity on the expand RAID set can then be used to create an additional volume sets, with a different fault tolerance setting if user need to change.



• Online RAID Level and Stripe Size Migration

User can migrate both the RAID level and stripe size of an existing volume set, while the server is online and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as in the event that additional physical disks are added to the RAID subsystem. For example, in a system using two drives in RAID level 1, you could add capacity and retain fault tolerance by adding one drive. With the addition of third disk, you have the option of adding this disk to your existing RAID logical drive and migrating from RAID level 1 to 5. The result would be parity fault tolerance and double the available capacity without taking the system off.

High availability

• Creating Hot Spares

A hot spare drive is an unused online available drive, which is ready for replacing the failure disk drive. In a RAID level 1, 1E 3, 5, 6 or 10 raid set, any unused online available drive installed but not belonging to a raid set can be defined as a hot spare drive. Hot spares permit you to replace failed drives without powering down the system. When RAID subsystem detects a drive failure, the system will automatically and transparently rebuild using hot spare drives. The raid set will be reconfigured and rebuilt in the background, while the RAID con-troller continues to handle system request. During the automatic rebuild process, system activity will continue as normal, however, the system performance and fault tolerance will be affected. Basically, the newly installed drive will be reconfigured an online free disk. But, the newest installed drive will be automatically assigned as a hot spare, if any hot spare disk was used to rebuild and without new installed drive replaced it.

Important:

The hot spare must have at least the same capacity as the drive it replaces.

• Hot-Swap Disk Drive Support

The RAID subsystem has built the protection circuit to support the replacement of SAS/SATA ll hard disk drives without having to shut down or reboot the system. The removable hard drive tray can de-liver “hot swappable,” fault-tolerant RAID solutions at prices much less than the cost of conventional SCSI hard disk RAID subsystems. We provide this feature for controllers to provide the advanced fault tolerant RAID protection and “online” drive replacement.

- **Hot-Swap Disk Rebuild**

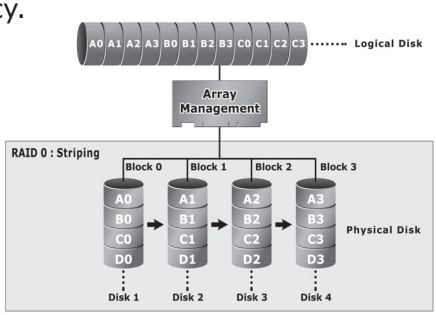
A Hot-Swap function can be used to rebuild disk drives in arrays with data redundancy such as RAID level 1, 10, 3, 5 and 6. If a hot spare is not available, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt. If a hot spare is available, the rebuild starts automatically when a drive fails. The RAID subsystem automatically and transparently rebuilds failed drives in the background with user-definable rebuild rates. The RAID subsystem will automatically restart the system and the rebuild if the system is shut down or powered off abnormally during a reconstruction procedure condition. When a disk is Hot Swap, although the system is functionally operational, the system may no longer be fault tolerant. Fault tolerance will be lost until the removed drive is replaced and the rebuild operation is completed.

Understanding RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provide high performance and fault tolerance. The RAID subsystem implements several levels of the Berkeley RAID technology. An appropriate RAID level is selected when the volume sets are defined or created. This decision is based on disk capacity, data availability (fault tolerance or redundancy), and disk performance. The following is the RAID level, which support in the RAID subsystem. The RAID subsystem makes the RAID implementation and the disks' physical configuration transparent to the host operating system. This means that the host operating system drivers and software utilities are not affected, regardless of the RAID level selected. Correct installation of the disk array and the controller requires a proper understanding of RAID technology and the concepts.

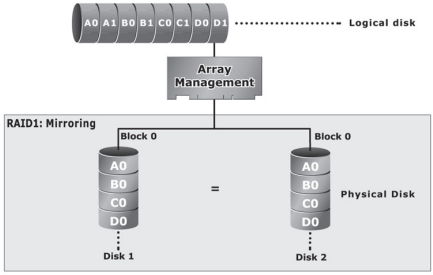
• RAID 0

RAID 0, also referred to as striping, writes stripping of data across multiple disk drives instead of just one disk drive. RAID 0 does not provide any data redundancy, but does offer the best high-speed data throughput. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in the array. Disk striping enhances performance because multiple drives are accessed simultaneously; but the reliability of RAID Level 0 is less than any of its member disk drives due to its lack of redundancy.



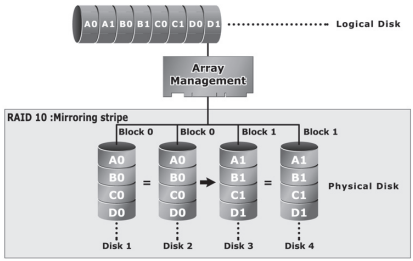
• RAID 1

RAID 1 also known as "disk mirroring", data written to one disk drive is simultaneously written to another disk drive. Read performance may be enhanced if the array controller can parallel accesses both members of a mirrored pair. During writes, there will be a minor performance penalty when compared to writing to a single disk. If one drive fails, all data (and software applications) are preserved on the other drive. RAID 1 offers extremely high data reliability, but at the cost of doubling the required data storage capacity.



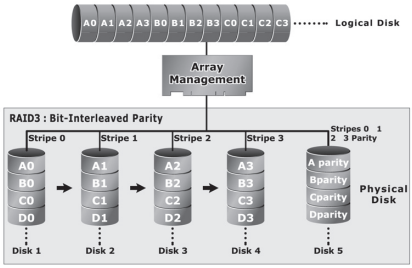
• RAID 10(1E)

RAID 10(1E) is a combination of RAID 0 and RAID 1, combing stripping with disk mirroring. RAID Level 10(1E) combines the fast performance of Level 0 with the data redundancy of Level 1. In this configuration, data is distributed across several disk drives, similar to Level 0, which are a stripe across a number of mirrored sets for data protection. RAID 10(1E) provides the highest read/write performance of any of the Hybrid RAID levels, but at the cost of doubling the required data storage capacity.



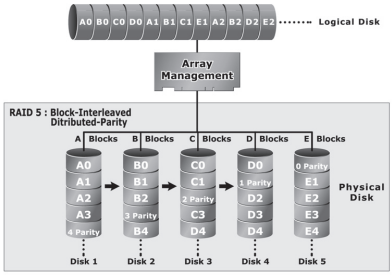
• RAID 3

RAID 3 provides disk striping and complete data redundancy through a dedicated parity drive. RAID 3 breaks up data into smaller blocks, calculates parity by performing an exclusive-or on the blocks, and then writes the blocks to all but one drive in the array. The parity data created during the exclusive-or is then written to the last drive in the array. If a single drive fails, data is still available by computing the exclusive-or of the contents corresponding stripes of the surviving member disk. RAID 3 is best for applications that require very fast data- transfer rates or long data blocks.



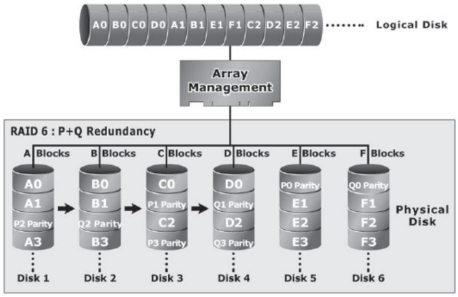
• RAID 5

RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the controllers rather than concentrated on a dedicated parity disk. If one drive in the system fails, the parity information can be used to reconstruct the data from that drive. All drives in the array system can be used to seek operation at the same time, greatly increasing the performance of the RAID system This relieves the write bottle-neck that characterizes RAID 4, and is the primary reason that RAID 5 is more often implemented in RAID arrays.



• RAID 6

RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater that RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data. RAID 6 is an extension of RAID 5 that uses a second independent distributed parity scheme. Data is striped on a block level across a set of drives, and then a second set of parity is calculated and writ-ten across all of the drives.

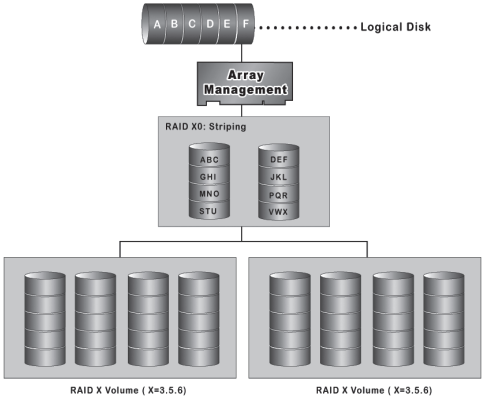


• RAID x0

RAID level-x0 refers to RAID level 30, 50 and 60. RAID x0 is a combination multiple RAID x volume sets with RAID 0 (striping). Striping helps to increase capacity and performance without adding disks to each RAID x array. The operating system uses the spanned volume in the same way as a regular volume. Up to one drive in each sub-volume (RAID 3 or 5) may fail without loss of data. Up to two drives in each sub-volume (RAID 6) may fail without loss of data.

RAID level x0 allows more physical drives in an array. The benefits of doing so are larger volume sets, increased performance, and increased reliability.

The following illustration is an example of a RAID level x0 logical drive.



Important:

RAID level 30, 50 and 60 can support up to eight sub-Volumes (RAID set). If the volume is RAID level 30, 50, or 60, you cannot change the volume to another RAID level. If the volume is RAID level 0, 1, 10, 3, 5, or 6, you cannot change the volume to RAID level 30, 50, or 60.

- **JBOD**

(Just a Bunch Of Disks) A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy.

- **Single Disk (Pass-Through Disk)**

Pass through disk refers to a drive that is not controlled by the RAID firmware and thus can not be a part of a RAID volume. The drive is available to the operating system as an individual disk.

Summary of RAID Levels

RAID subsystem supports RAID Level 0, 1, 10(1E), 3, 5, 6, 30, 50 and 60. The following table provides a summary of RAID levels.

RAID Level Comparsion			
RAID Level	Description	Disks Requirement (Minimum)	Data Availability
0	Also known as striping. Data distributed across multiple drives in the array. There is no data protection.	1	No data Protection
1	Also known as mirroring. All data replicated on 2 separated disks. N is almost always 2. Due to this is a 100 % duplication, so is a high costly solution.	2	Up to one disk failure
10(1E)	Also known as mirroring and striping. Data is written to two disks simultaneously, and allows an odd number or disk. Read request can be satisfied by data read from wither one disk or both disks.	3	Up to one disk failure in each sub-volume
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all data disks. Parity information normally stored on a dedicated parity disk.	3	Up to one disk failure
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity information normally is interspersed with user data.	3	Up to one disk failure

6	RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater that RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data.	4	Up to two disk failure
30	RAID 30 is a combination multiple RAID 3 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
50	RAID 50 is a combination multiple RAID 5 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
60	RAID 60 is a combination multiple RAID 6 volume sets with RAID 0 (striping)	8	Up to two disk failure in each sub-volume